

# Immunity to Microbes

Dr. Ahmed Hasan

# Immunity to Fungi

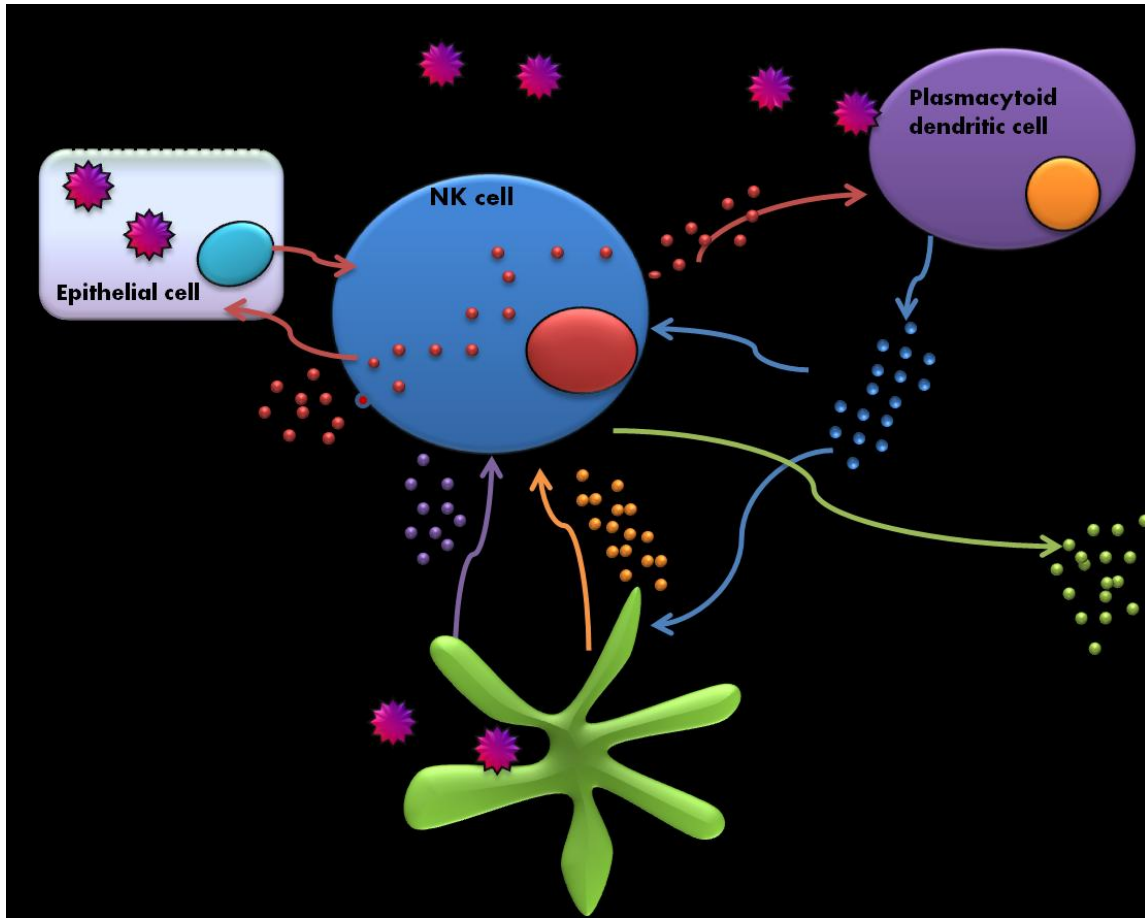
- Neutrophils and macrophages serve as the outstanding mediators of innate immunity against fungal infections.
- Neutrophils release lysosomal enzymes and fungicidal substances like reactive oxygen species, which phagocytose fungi to kill them within the cell.
- Cell-mediated immunity is effective mechanism of adaptive immunity against fungal infections. It functions by preventing the spread of fungi to other tissues. Certain Fungi also evoke antibody response of protective value.

# Immunity to viruses

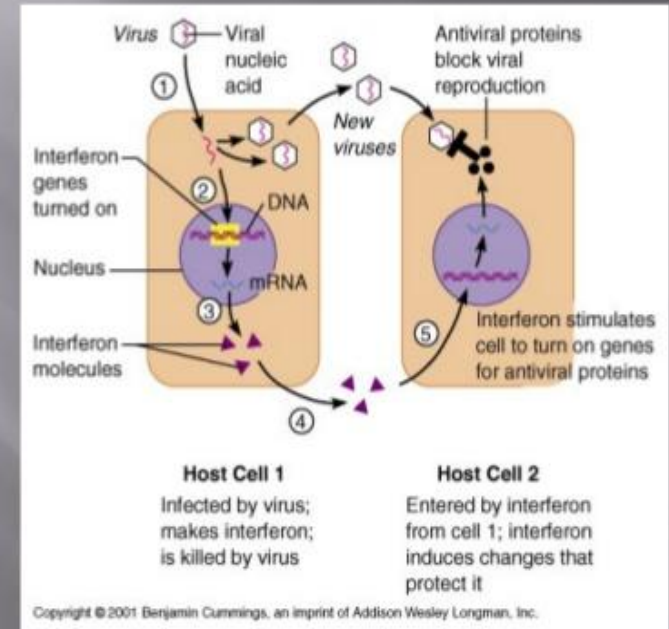
- Immune responses towards viruses either function by blocking the infection or by getting rid of infected cells. Type I interferons participate in innate immunity while neutralizing antibodies take part in the adaptive immunity.

# Innate immunity to viruses

- Type I interferons inhibit the infection while the killing of infected cells is mediated by Natural killer (NK) cells.
- Type I interferons prevent viral replication by triggering an “antiviral state”.
- NK cells are significant in early stages of the infection because in later stages adaptive immune responses progress. NK cells kill the infected cells and also identify infected cells where the virus has shut off class I MHC expression as an evading mechanism from CTLs. The importance of evading mechanism lies in the fact that the liberation of NK cells from a normal state of inhibition occurs only when MHC class I expression is turned out and not active.

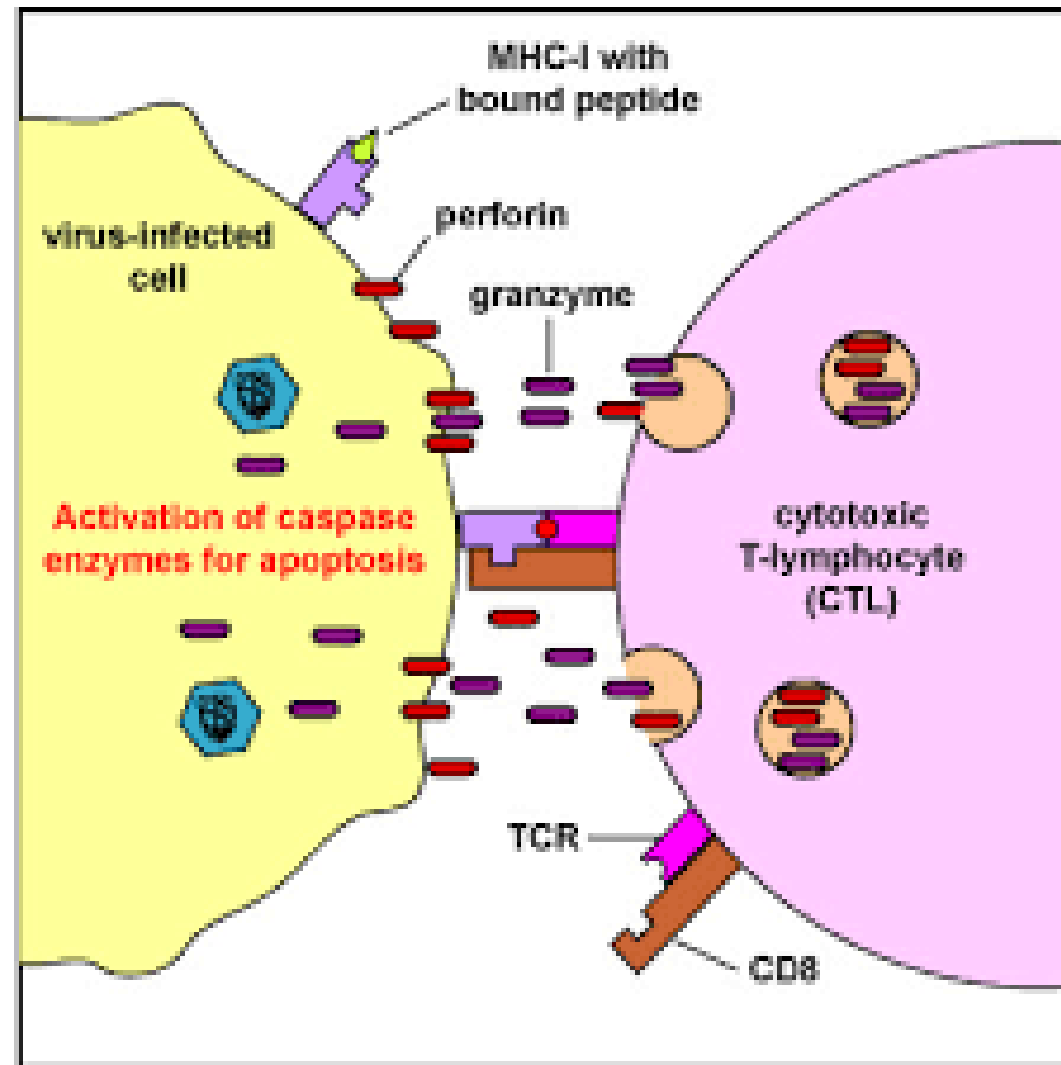


# Interferons



# Adaptive immunity to viruses

- High affinity antibodies produce adaptive immune response against viral infections by preventing virus binding to the host cells, and by CTLs which bring out elimination of infected cells by killing them.
- CTLs like CD8+ T-cells identify viral peptides by class I MHC molecule.
- Further virus infected cell is phagocytosed by the antigen presenting cells such as dendritic cells. Dendritic cells process the viral antigen and present it to naïve CD8+ T-cells. Some of the CD8+ T-cells replicate massively to kill the infected cells. In some cases the virus persists in the infected individual without active replication leading to latent infection. CTLs may lead to tissue injury even if the infectious virus is not dangerous to the body.



# How viruses deceive immune system?

Viruses have adopted numerous strategies for escaping the immune system.

- Viruses can change their surface antigens to avoid immune response. Generally surface glycoproteins containing T-cell epitopes undergo changes by point mutation or reassortment of genes especially in RNA viruses.
- Some viruses escape the immune surveillance by inhibiting the antigen presentation process and by inactivating the immunocompetent cells.
- Suppression of immunosuppressive molecules is also one of the strategies adopted by viruses.



# Immunity to Parasites

- Parasitic infections are mostly the infections caused by protozoa, ectoparasites and helminths. The parasitic infections are mostly chronic because of weak innate immunity. Besides weak immunity, parasites have a knack of evading host immune response very easily.

# Innate immunity to parasites

- Phagocytosis is the main innate immune response to parasitic infections but many parasites are able to escape the immune system. E.g. some helminths have thick teguments that enable them to evade the cytotoxic mechanism of neutrophils and macrophages.
- Very few parasites have the potential to activate alternate pathway of complement system but the parasites that recoup from infected patients acquire resistance to complement mediated lysis.

# Adaptive immunity to parasites

- Parasites exhibit diverse adaptive immune response. Cell mediated immunity is the principal defense mechanism against parasitic infections.
- Stimulation of macrophages by Th1 cell derived cytokines is especially directed by cell mediated immunity to neutralize the antigens.
- Helminths are removed by IgE antibody and eosinophil-mediated killing as well as other leukocytes.

# Immune evasion by Parasites

- Parasites have varied mechanism to evade immune response due to some modifications. — Parasites escape the immune system by preventing host immune response and by discounting their immunogenicity.
- They evade immune mechanism by bringing antigenic variation including changes in surface antigens by masking or shedding their antigens.
- One more way to evade immune response is by developing resistance to immune effector mechanisms.