Immune response to infections

Factors influencing the severity of infection

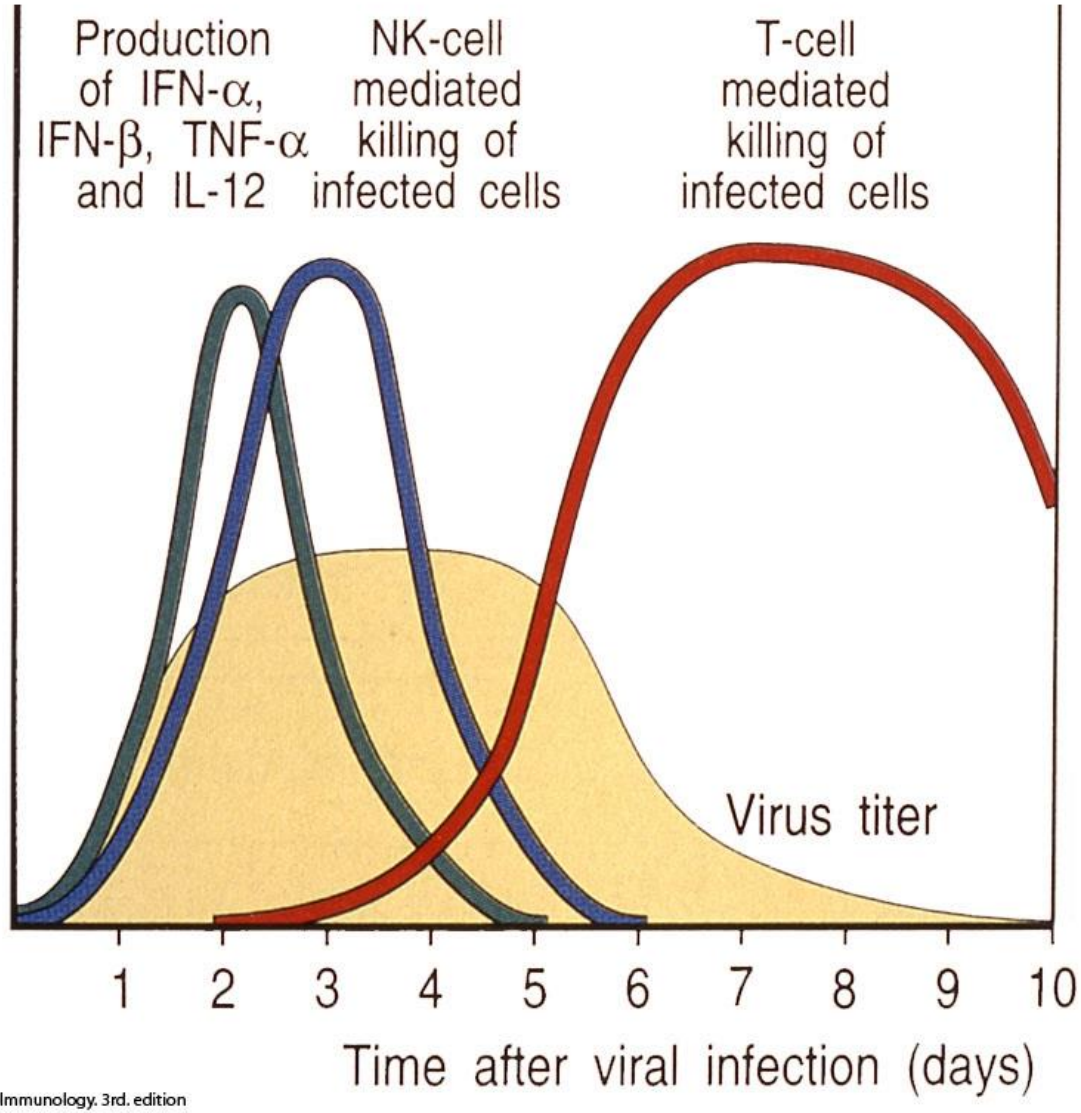
- **Pathogen factors**
  - **Dose**
  - **Virulence of organism**
  - **Route of entry**
- **Host factors**
  - **Integrity of non-specific defence barriers**
  - **Competence of the immune system**
  - **Genetic influences**
  - **Previous exposure to antigen**
  - **Existence of co-infection**

Immune response to viral infections

- **Non-speciphic immunity**
  - **Interferons (α and β)**
  - **Natural killer cells (NK cells)**
  - **Receptor-like molecules in various secretions**

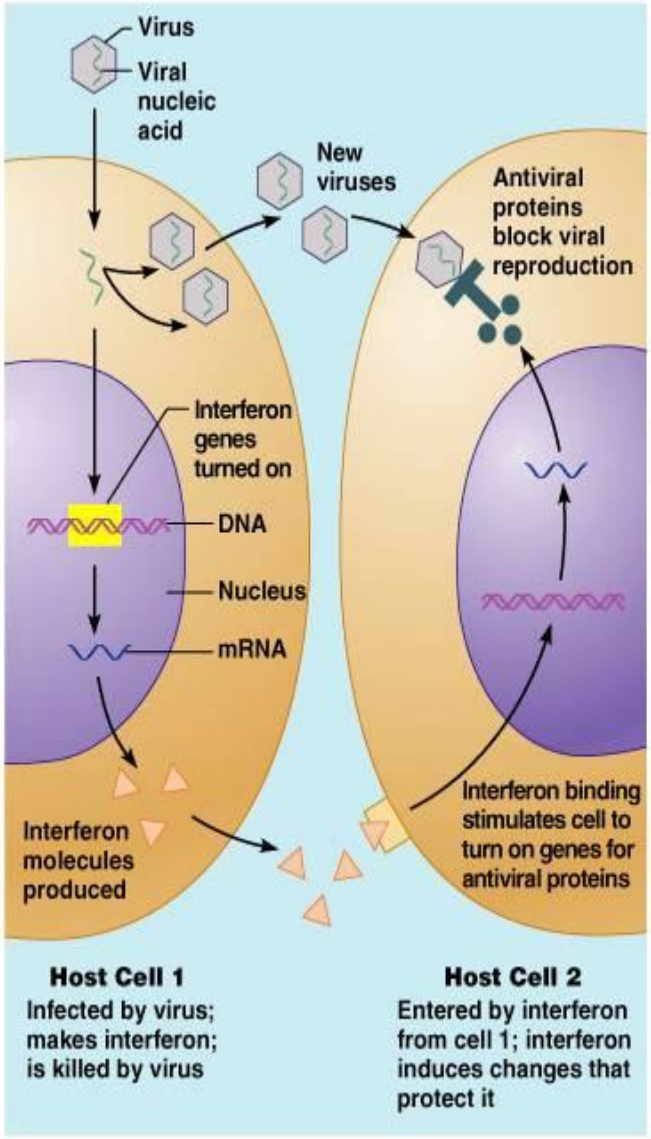
- **Speciphic immunity**
  - **Antibodies – neutralization of extracellular viruses**
  - **Tc lymphocytes – elimination of virus-infected cells**

Mechanisms of antiviral immunity



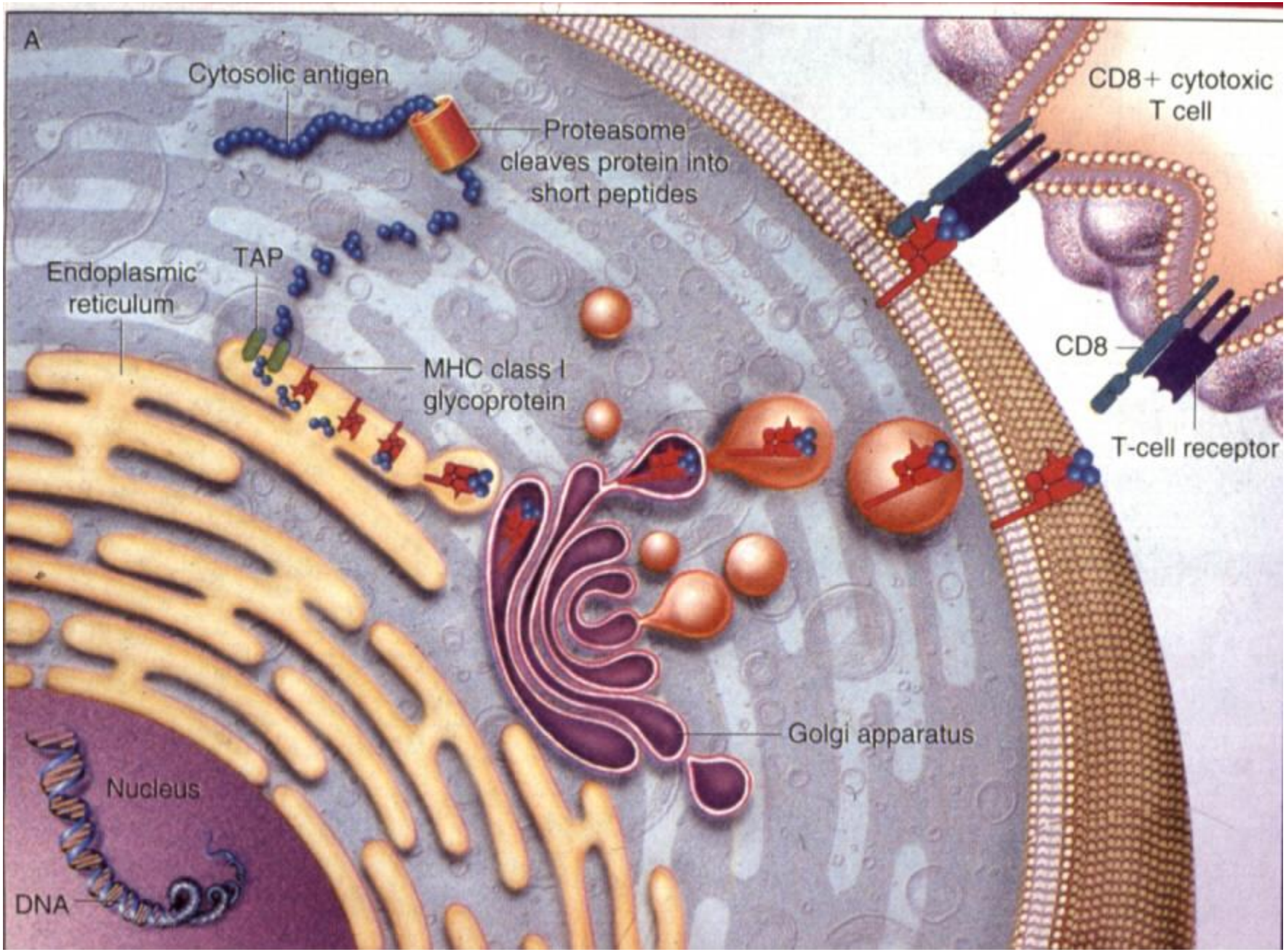
From: I. Roit et al: Slide atlas of Immunology. 3rd. edition

The action of interferon (IFN)



Natural killers (NK cells)

- Originate in non-T non-B lymphocyte lineage.
- Morphologically: large granulated lymphocytes (LGL).
- Recognition of target cells in antigen non-speciphic.
- Virus infected and tumor cells are killed.
- Target cells are recognisd mainly by decreased HLA-I expression.
- Cytotoxic mechanisms are similar to Tc cells: perforin and induction of apoptosis.


A
Cytosolic antigen
Proteasome cleaves protein into short peptides
TAP
Endoplasmic reticulum
MHC class I glycoprotein
CD8+ cytotoxic T cell
CD8
T-cell receptor
Golgi apparatus
Nucleus
DNA

Viral strategies to evade the immune response

- **Antigenic variations**
  - **antigenic drift - minor changes**
  - **antigenic shift - major changes**
- **Long-term survival in a host**
  - **Viral persistence – virus van be detected in periphery (e.g. chronic hepatitis B)**
  - **Viral latency – virus is „hidden“ e.g. herpesviruses**
  - **Oncogenic transformation**
- **Immunosuppressive effect of viruses**

Immunosuppressive effects of viruses

- Suppression of T-cells : HIV, morbilli, CMV,
- Inhibition of MHC antigens expression: CVM (binds β-2 microglobulin), Adenoviruses, RSV - decreased expression of HLA antigens
- Production of inhibitory cytokies: EBV (IL-10 - like factor)

Damage of a host caused by anti-viral immune response

- Autoimmune diseases: hemolytic anemia after EBV infection (polyclonal stimulation), autoimmune hepatitis induced by hepatitis-B virus (aberrant HLA-II expression and other mechanisms).
- Immune complex diseases: arthritis in hepatitis B, vasculitis.
- Tc - mediated diseases: rash in exanthematic viral diseases, myocarditis caused by coxackie virus.

Immune responses to bacterial infections

- **Non-specific immunity**
  - **Mechanical barriers**
  - **Phagocytosis**
  - **Complement system**
- **Specific immunity**
  - **Antibodies - opsonisation, complement-activation, neutralisation of toxins, binding to receptors**
  - **T-lymphocytes - against intracellular parasites**

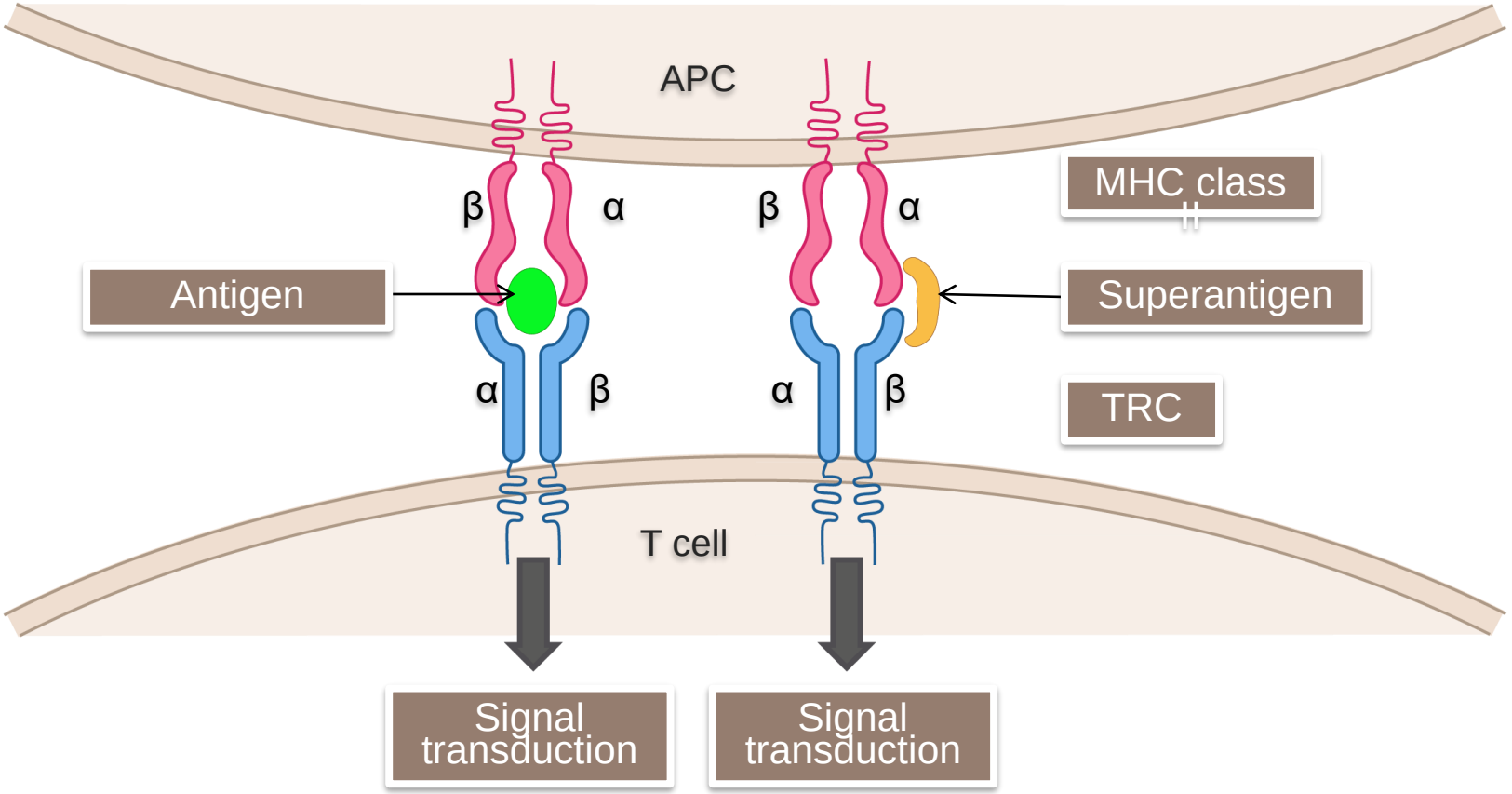
Bacterial evasions of immune defences

- Antiphagocytic machanisms: toxins, capsular polysaccharides
- Inhibition of the complement system: *Str. pyogenes, E. coli, N. meningitidis*
- Antigenic variations: *Borrelia recurrentis*
- Proteases lysing IgA - *Neisseria, Haemophilus*
- Sequestration in avascular regions- *Salmonella typhi* in the gall bladder and urinary tract
- Intracellular parasitism

Macroorganism damage caused by the immune response to bacterial infection

- **Autoimmune diseases**
  - **Cross-reactivity of bacterial and body antigens - rheumatic fever**
  - **Type-II hypersensitivity - autoimmune hemolytic anemia caused by *Mycoplasma* infection**
  - **Heat shock proteins**
  - **Superantigens (streptococcal, staphylococcal)**
- **Immunocomplex diseases**
- **Type IV hypersensitivity- cavitation in pulmonary tuberculosis**

Activation of TCR by antigen and superantigen



Mechanisms of anti-fungal resistance

- Normal bacterial flora
- Phagocytic cells
- T-lymphocytes -probably most important
- Antibodies - usually present, but have no protective effect

Imunity against parasites

- Different mechanisms involved against different parasites.
- Immune response frequently leads to premunity – the situation when the parazite perzists, however it does not lead to dissemination and new infections.
- IgE and esinophils play a crucial role.

Role of IgE and mastocytes in protection against parasites