Immunity against virus

Lec. 12

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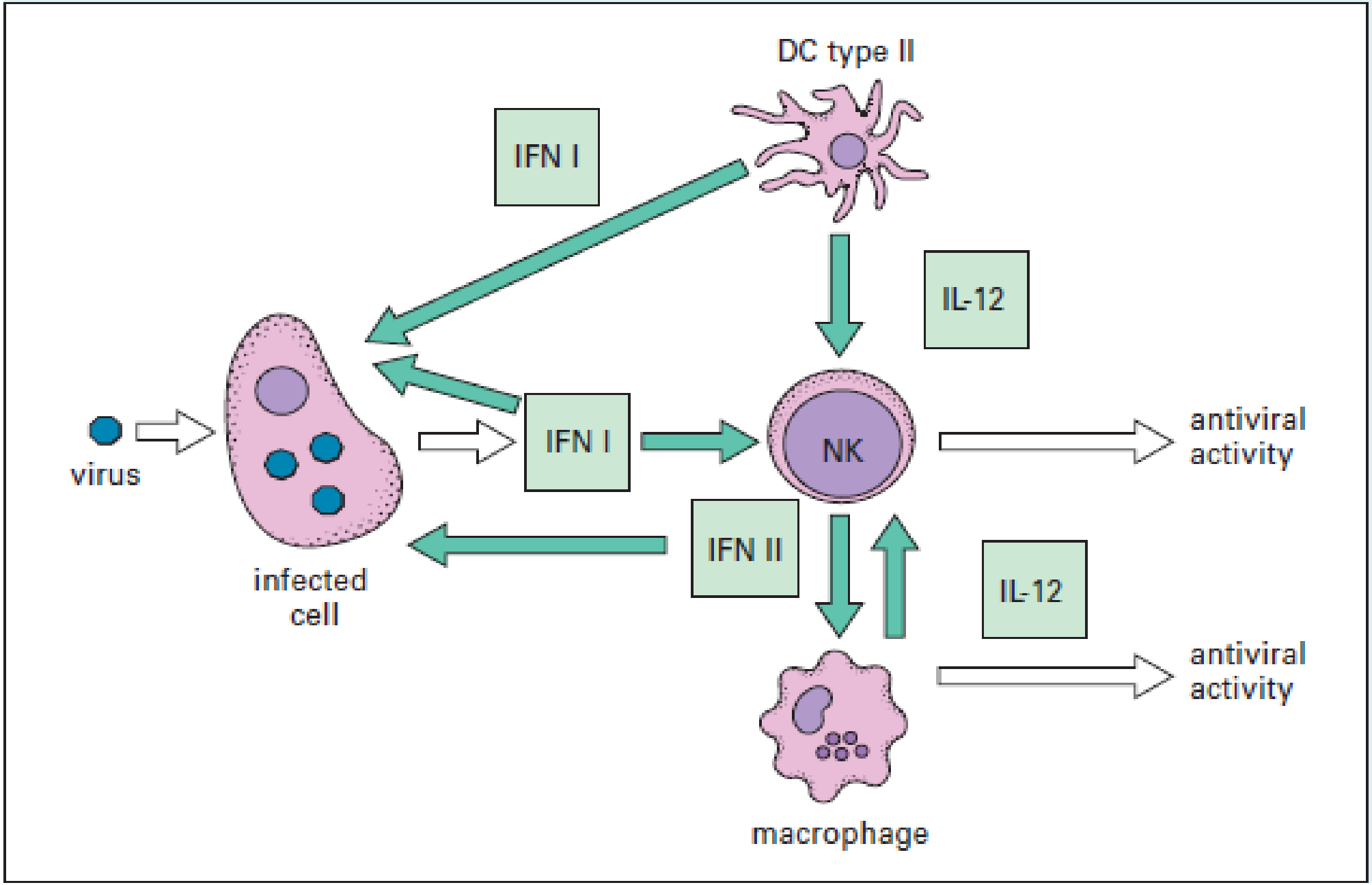
Objectives of lecture

- At the end of this lecture you can able to explain:
- Innate immunity to virus
- Adaptive immunity to virus
- Viruses evasion the immune response
- Boosting anti-viral immunity

Anti-viral immunity (innate)

- The early immune defenses against viruses include **interferon, NK cells, and macrophages** which restrict the early stages of infection and delay spread of virus.
- **Interferons** exert antiviral activity by a variety of mechanisms.
- **NK cells** are cytotoxic for virally infected cells, Active NK cells are detected within 2 days of a virus infection
- **Macrophages** act at three levels to destroy virus and virus-infected cells.
- DC2 dendritic cells produce IFNα in herpesvirus and influenza virus infection.

Interferon activates NK cells and macrophages



Anti-viral immunity (adaptive)

- If the innate immunity fail to stop spread a viral infection, the adaptive (specific) immune response unfolds. **Cytotoxic T lymphocytes (CTLs); helper T (TH) cells;** and **antiviral antibodies** can limit viral spread or reinfection.
- **Cytotoxic T lymphocytes CD8+ CTLs** destroy virus infected cells;
- **Helper CD4+ T cells** are a major effector cell population in the response to many virus infections.
- **Antibodies** provide a major barrier to virus spread between cells and tissues by neutralization virus particals and are particularly important in restricting virus spread in the blood stream.

Antiviral effects of antibody

target	agent	mechanism
free virus	antibody alone	blocks binding to cell blocks entry into cell blocks uncoating of virus
	antibody + complement	damage to virus envelope blockade of virus receptor
virus-infected cells	antibody + complement	lysis of infected cell opsonization of coated virus or infected cells for phagocytosis
	antibody bound to infected cells	ADCC by NK cells, macrophages, and neutrophils

ADCC, antibody-dependent cellular cytotoxicity

Response to a typical acute virus infection

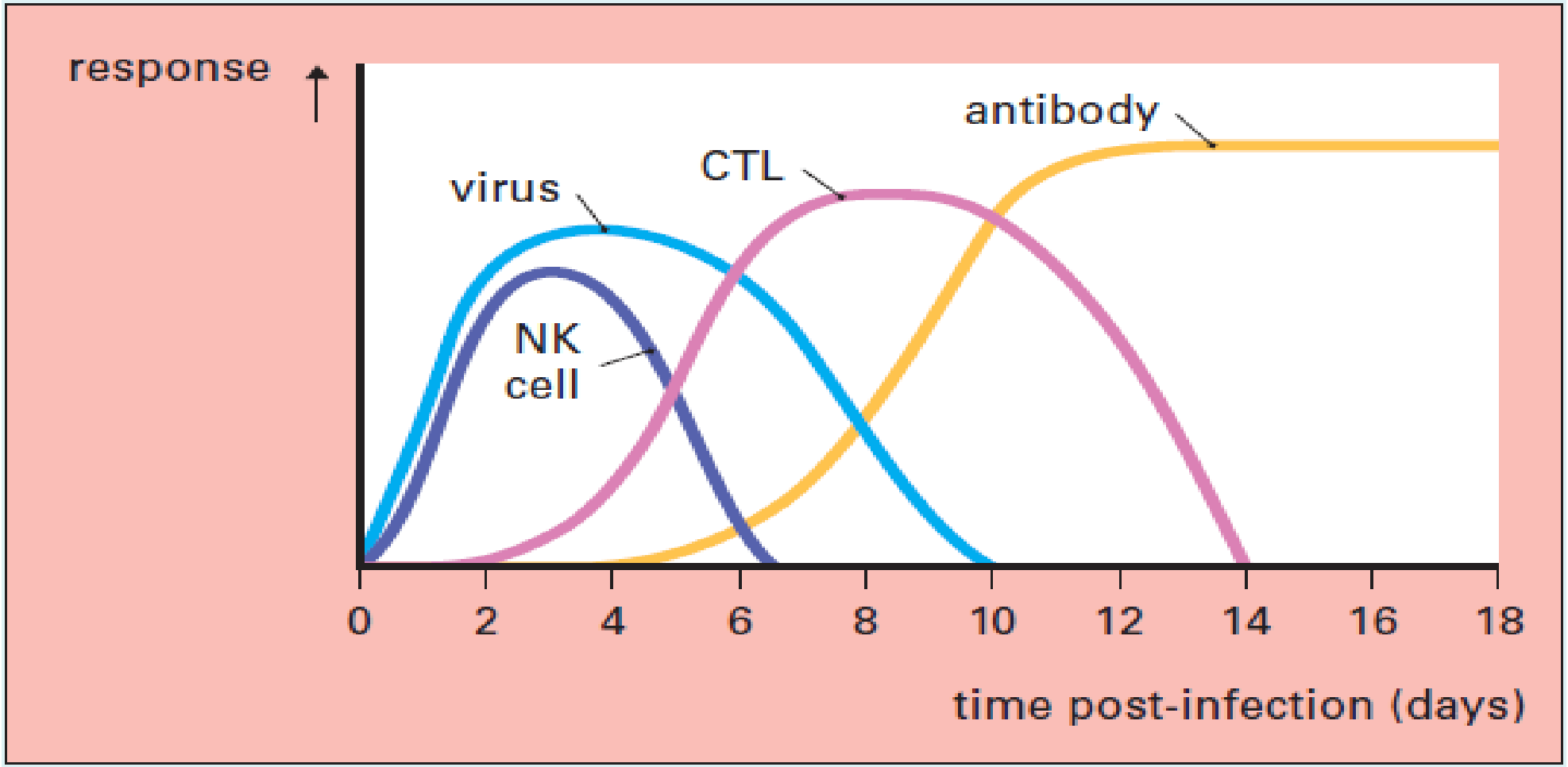
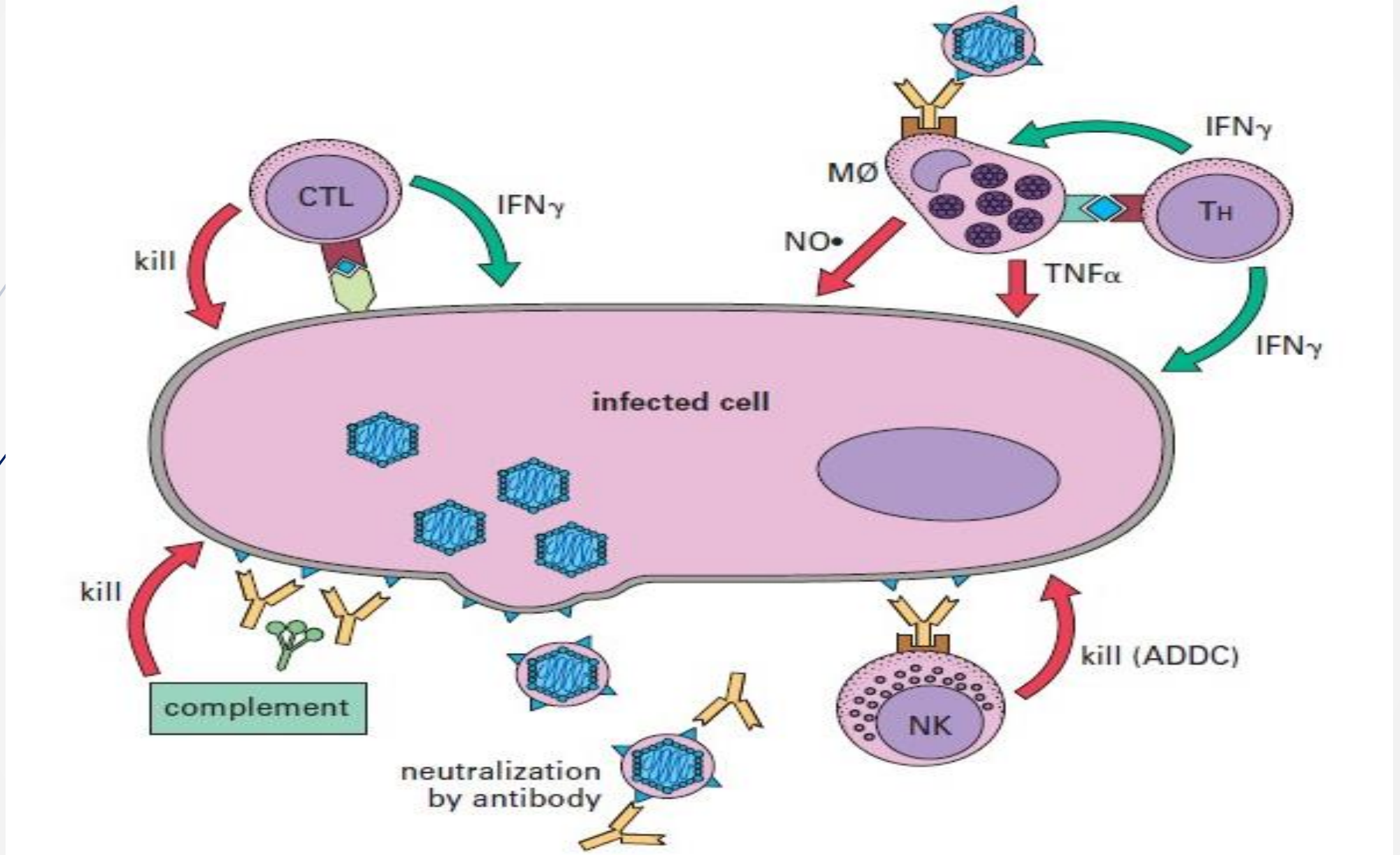


Fig. 13.6 Kinetics of host defenses in response to a typical acute virus infection. Following an acute virus infection (e.g. by influenza or herpes virus), NK cells and interferon are detected in the blood stream and locally in infected tissues.

Effector mechanisms against virus and virus-infected cells



Viruses evasion the immune response

- **Virus latency** and **antigenic variation** are the most effective mechanisms.
- **Virus latency of herpes simplex virus (HSV)** latent in the neuron and reactivate in immunocompromised and under stress individuals.
- **Antigenic variation** is seen in human immunodeficiency virus (HIV) which infects CD4+ cells and in foot and mouth disease virus, and is responsible for the **antigenic shift and drift seen with influenza virus**
- Many viruses deviate the immune response by the production of cytokine analogs and cytokine receptor analogs.

Viruses evasion the immune system

Mechansim of Immune Evasion	Examples
Antigenic variation	Influenza, rhinovirus, HIV
Inhibition of antigen processing	
Blockade of TAP transporter	Herpes Simplex
Removal of class I molecules from ER	Cytomegalovirus
Production of cytokine Receptor homologs	Vaccinia, Poxviruses
Production of Immunosuppressive cytokines	Epstein-Barr virus
Infection of Immunocompetent cells	HIV

Boosting anti-viral immunity

1. Low-carb nutrition and immune function
2. Proper hand washing, Don't smoke & alcohol drink, Get adequate sleep, The right amount of exercise, Stress management
3. Food suplements; VitC,D, Zinc, curcumin, Garlic
4. Food such fruits and Chicken soup/bone broth

Thank you