

بِسْمِ اللَّهِ الرَّحْمَنِ الرَّحِيمِ

Pathogenesis of viral infection

(Foundation Block, Microbiology :2016)

By: Dr.Malak M. El-Hazmi

OBJECTIVES

- *definition and levels of viral pathogenesis.*
 - cellular level.*
 - host level.*
- *The immune response to viral infection.*
- *The stages of viral infection.*
- *The types of viral infections at host level.*

Pathogenesis of viral infection

❖ Viral disease at the cellular level

➤ Cytopathogenesis

❖ Viral disease at the host level

➤ Mechanism of the disease

Cytopathogenesis:

The types of viral infections at cellular level

The effects on cells/
Type of Infection

Virus Production

➤ Abortive

Vs not produced

➤ Productive

- Cytolytic
- Non-cytolytic

Vs Produced

Vs Produced

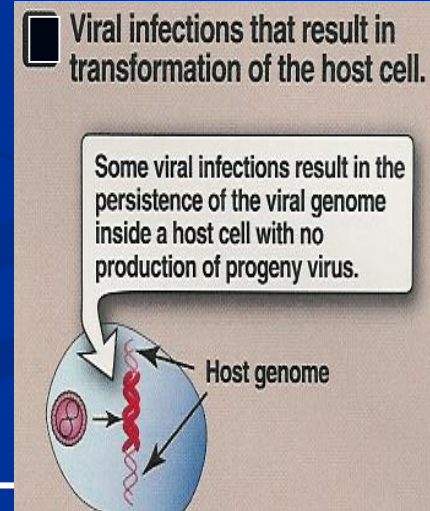
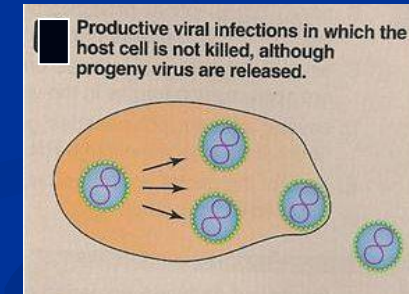
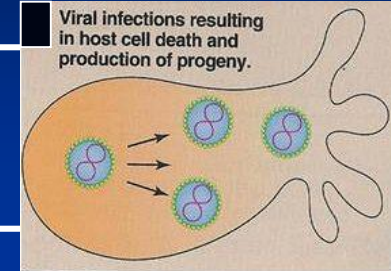
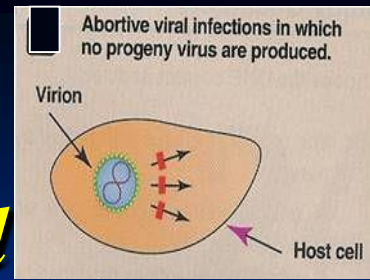
➤ Non-productive

Vs not Produced

- Latent
- Transformation

Viral NA present

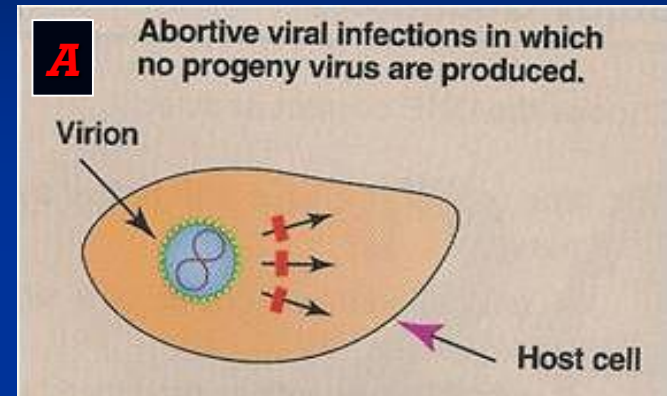
Viral NA present



The types of viral infections at cellular level

A) Abortive Infections:

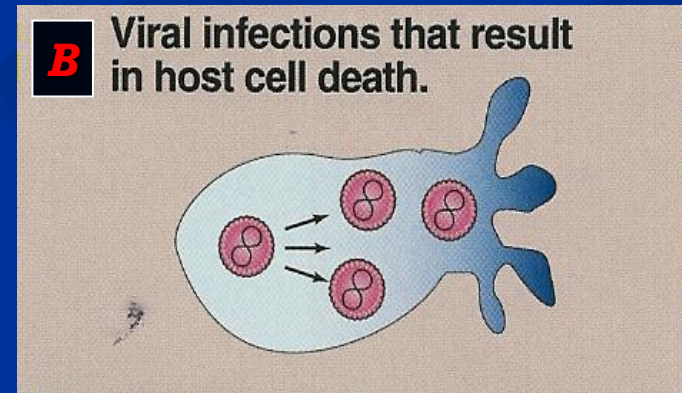
- Viruses don't complete the replication cycle
- Due to mutation, defective interfering particles & the action of IFNs



B) Productive Infections:

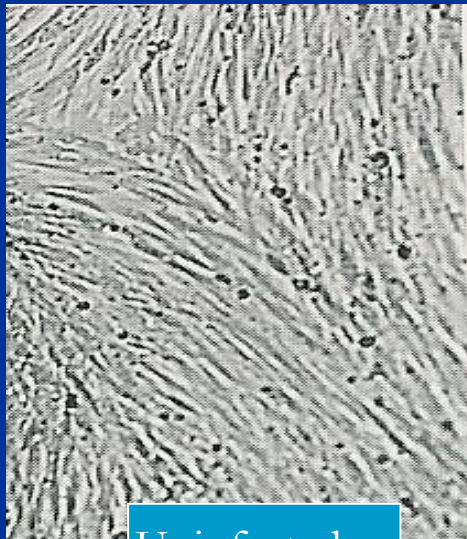
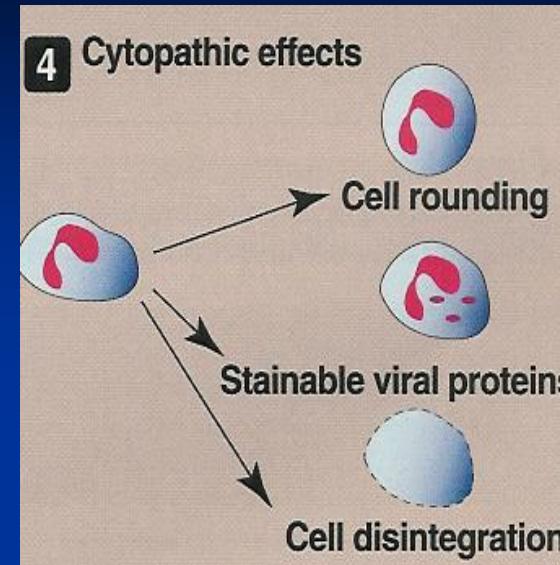
1. Cytolytic Infections

- Viruses replicate & produce progeny
- Cell death & Cytopathic effects [CPE]
- Inhibition of cellular protein & NA synthesis

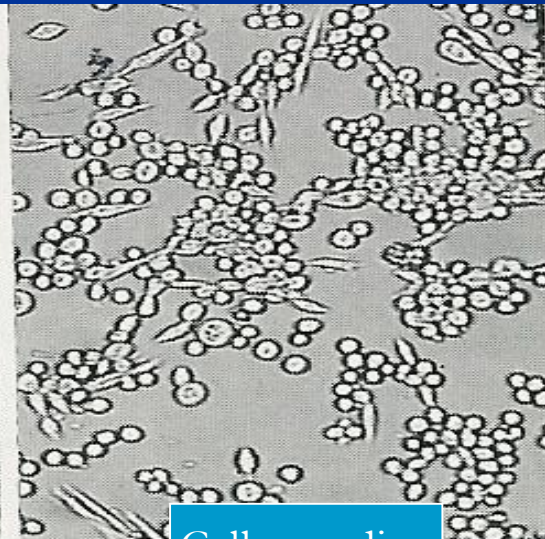


Cytopathic Effects

- CPE can take several forms:
 1. Cell lysis
 2. Cell rounding
 3. Syncytium formation
 4. Inclusion bodies formation



Uninfected cc



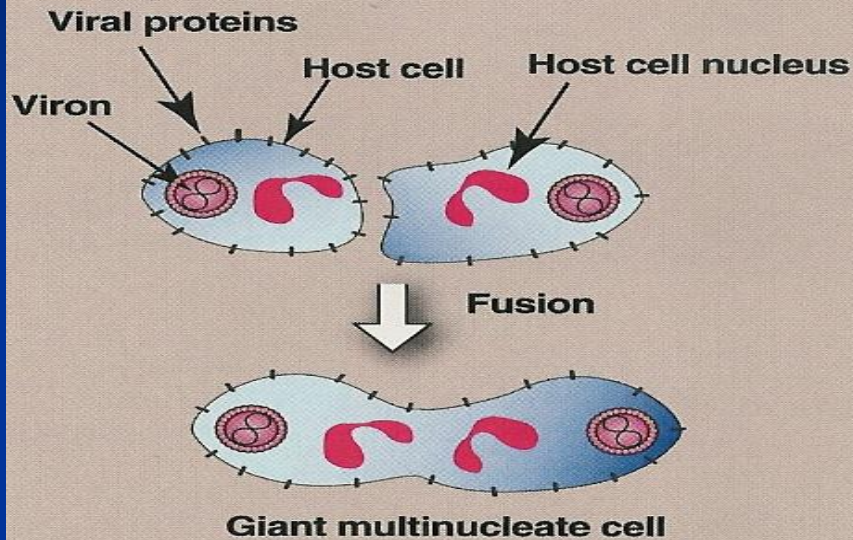
Cell rounding



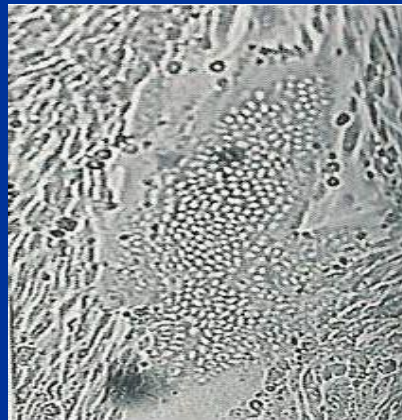
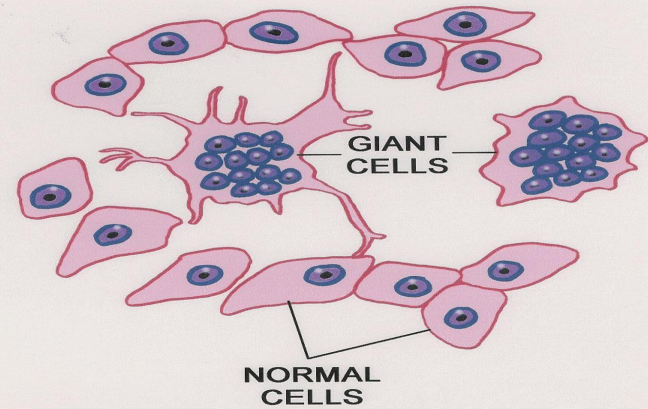
Syncytium

Syncytium formation

3 Viral infections that result in host cell fusion



GIANT CELL FORMATION (SYNCETIUM)



Syncytium

Inclusion bodies formation



Site:

Intranuclear [Herpes V.]

Intracytoplasmic [Rabies V.]

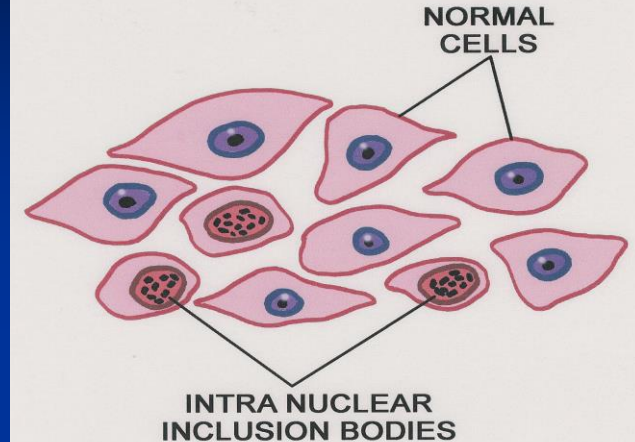


Take several forms:

- Small/large
- Single/multiple
- Round/irregular

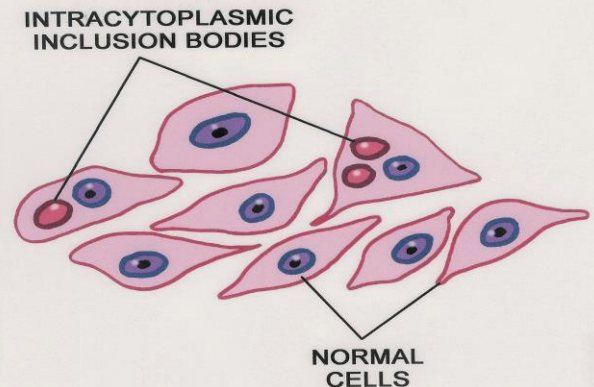
INCLUSION BODIES :

The site of VIRAL multiplication and protien synthesis



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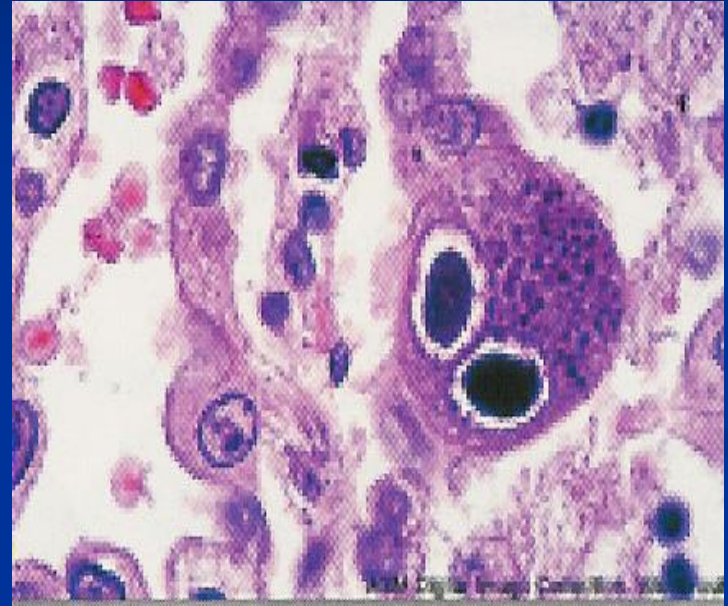
The site of VIRAL multiplication and protien synthesis



Inclusion bodies formation



*Negri bodies caused by
Rabies virus*



*Owl's eye inclusions
caused by CMV*

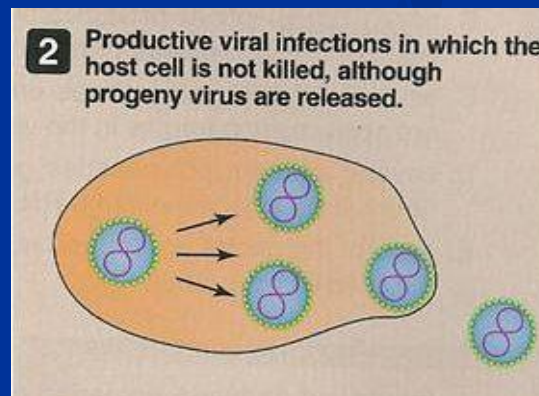
The types of viral infections at cellular level

B) Productive Infections:

1. Cytolytic Infections

2. Non-cytolytic infections :

- Viruses replicate & produce progeny
- Vs released by cell budding & little or no CPE



The types of viral infections at cellular level

C) Non-productive Infections:

- Vs infect cells that restrict or lack the machinery for transcribing viral genes.
- Viral genome is found either integrated into cell DNA or as a circular episome or both.

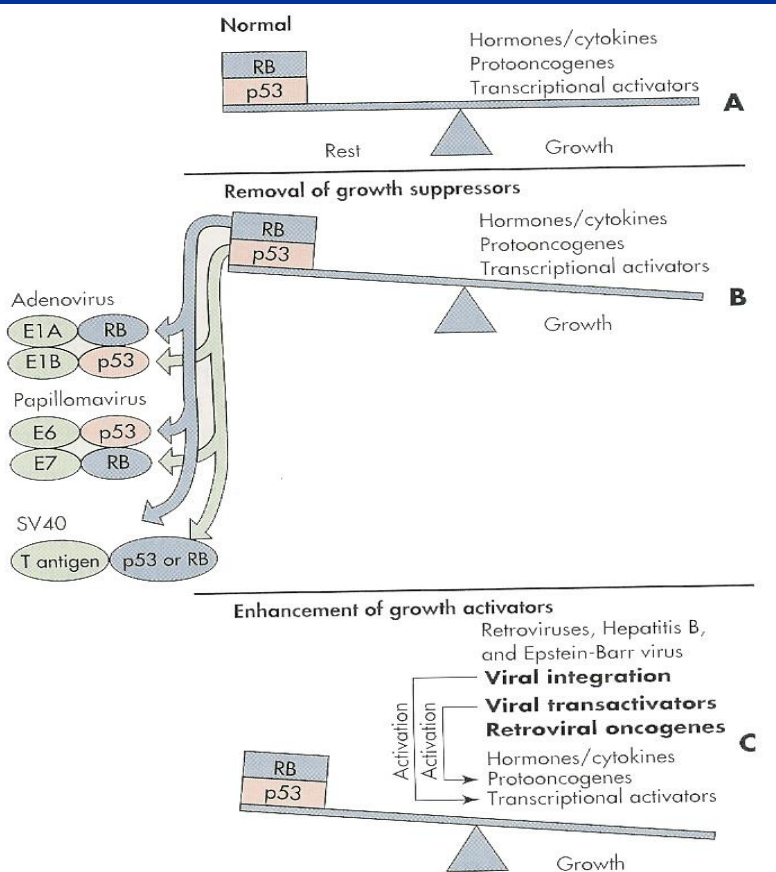
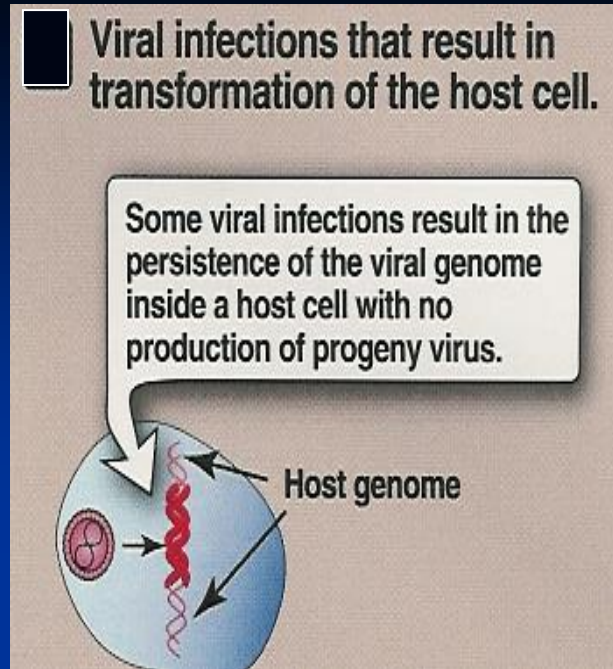
1) Latent Infection:

- Persistent inf b/c
there is limited expression of viral genes
- Ex: HSV

2) Transformation:

Transformation:

- Ex ; EBV, HPV and HTLV
- Cause tumor in animals & H and can transform cell culture



Vs can stimulate uncontrolled cell growth causing Tf by alternating the balance between growth activators & growth suppressors gene products

Cytopathogenesis:

The types of viral infections at cellular level

The effects on cells/
Type of Infection

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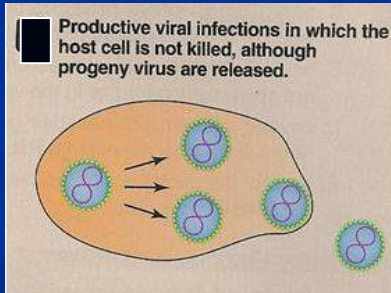
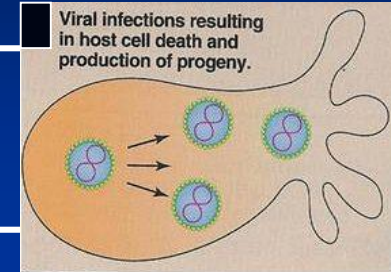
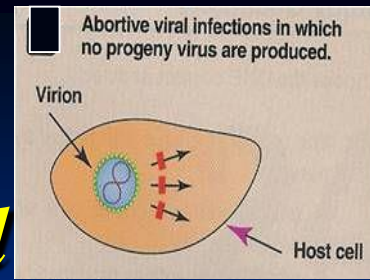
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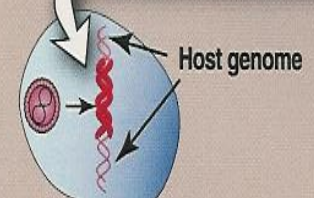
Viral NA present

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Viral infections that result in transformation of the host cell.

Some viral infections result in the persistence of the viral genome inside a host cell with no production of progeny virus.



Pathogenesis at Host Level

- Transmission of the virus & its entry into the host.
- Replication of the virus
- Vs remain localized or spread to other organs
- Viral shedding

- The immune response as
 - Host defense
 - Immunopathogenesis

Transmission

1. Person to person

a) Horizontal transmission

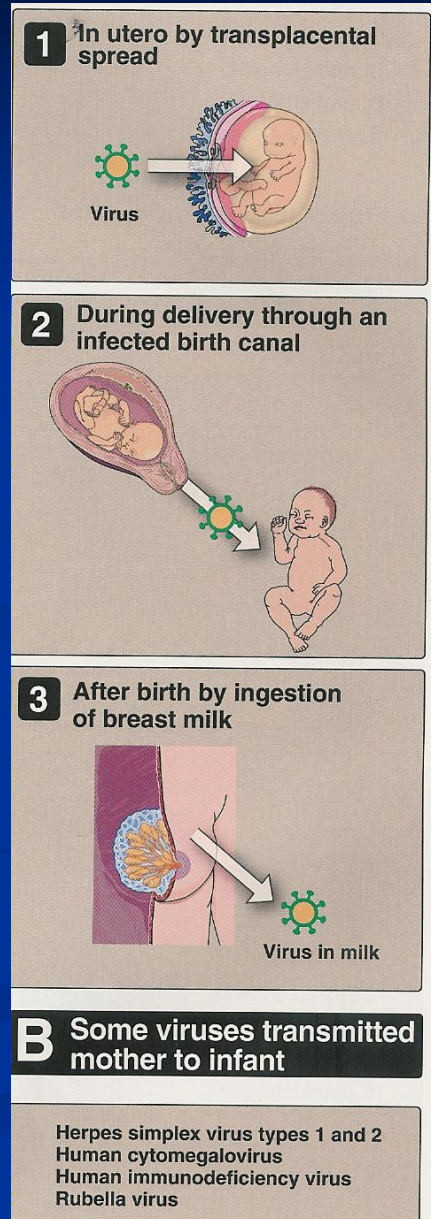
- Skin contact , Blood
- Respiratory route
- Fecal - oral route
- Genital contact

b) Vertical transmission

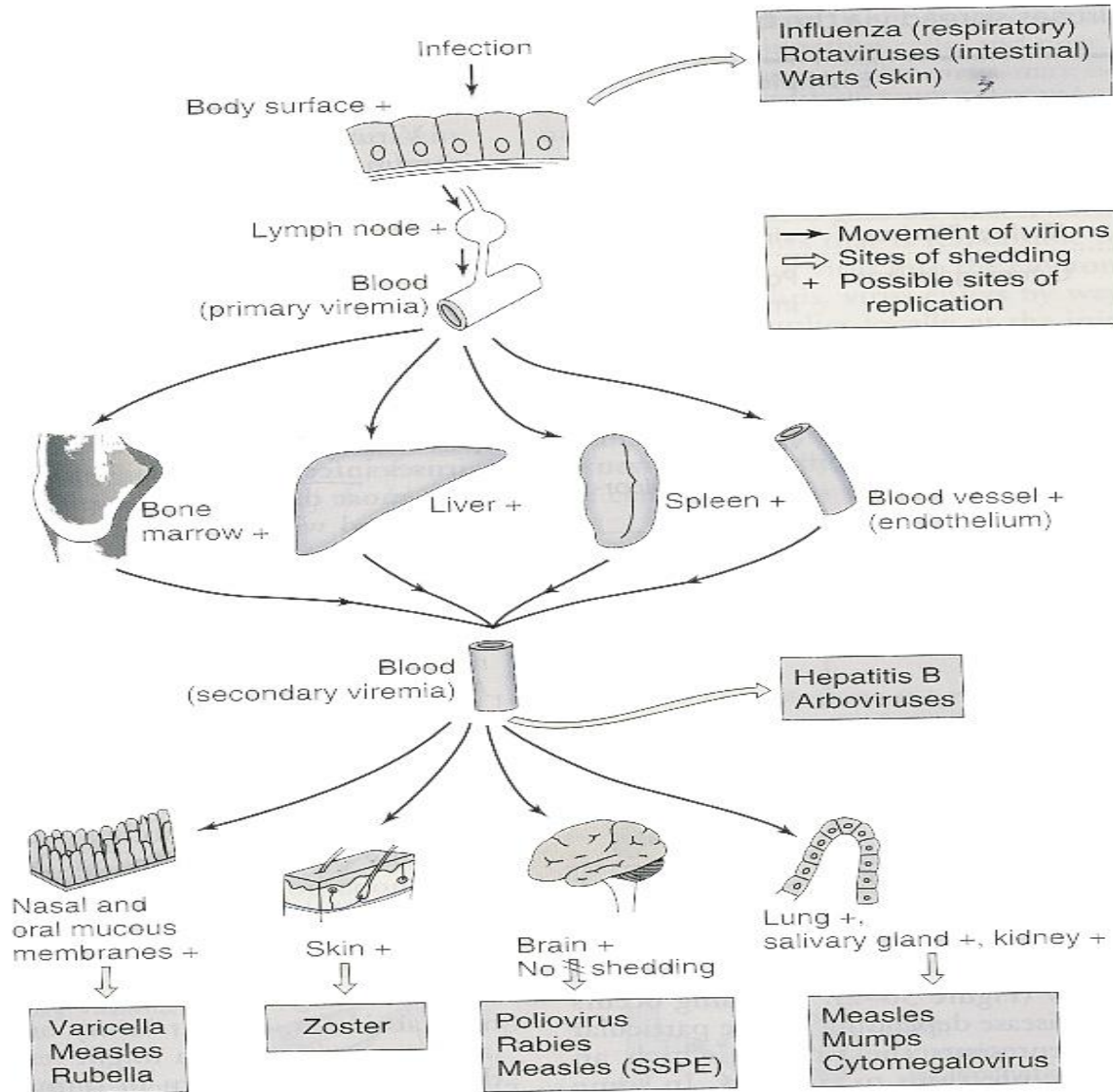
2. Animal to person

Reservoir \longrightarrow *Human (Rabies v.)*

Reservoir $\xrightarrow{\text{vector}}$ *Human (YFV)*



Mechanisms of spread of virus through the body

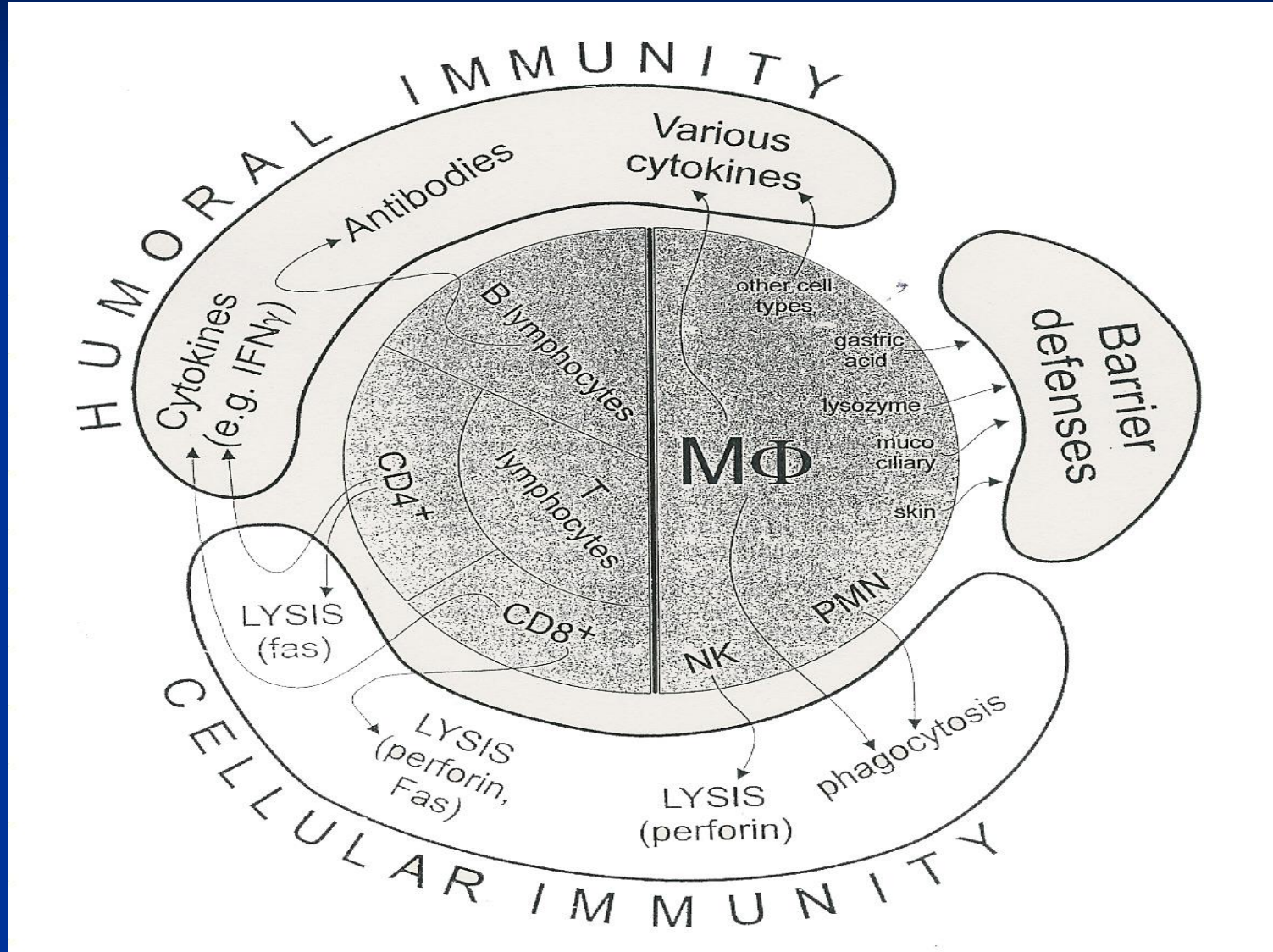


Virus shedding

Important features of Acute Viral Diseases

	<i>Local Infections</i>	<i>Systemic Infections</i>
<i>Ex. of specific Disease</i>	<i>Rhinovirus</i>	<i>Measles</i>
<i>Site of Pathology</i>	<i>Portal of entry</i>	<i>Distant site</i>
<i>IP</i>	<i>Relatively short</i>	<i>Relatively long</i>
<i>Viremia</i>	<i>Absent</i>	<i>Present</i>
<i>Duration of Immunity</i>	<i>Variable- may be short</i>	<i>Usually life long</i>
<i>Role of Secretory AB [IgA] in resistance</i>	<i>Usually important</i>	<i>Usually not important</i>

The immune response to virus



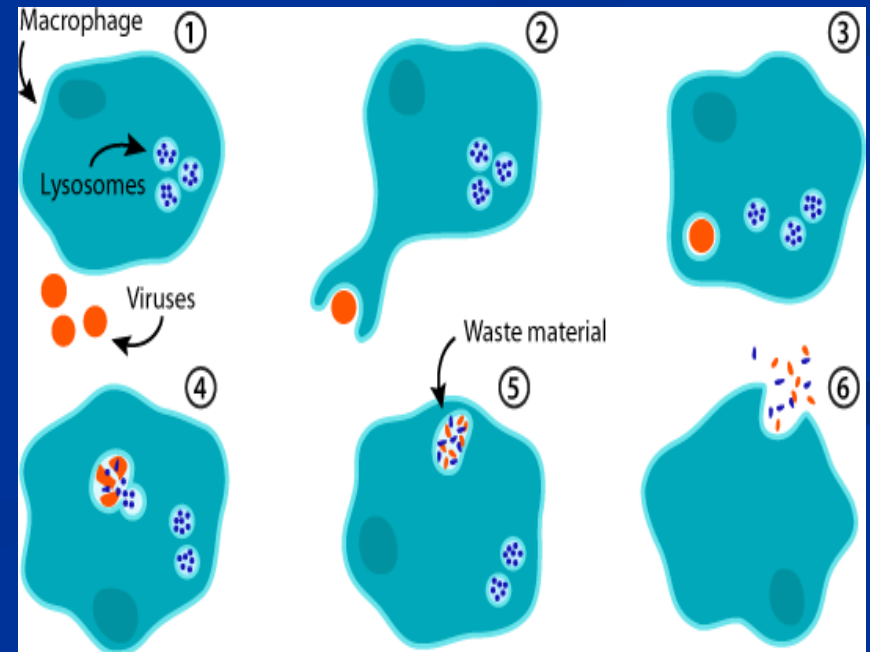
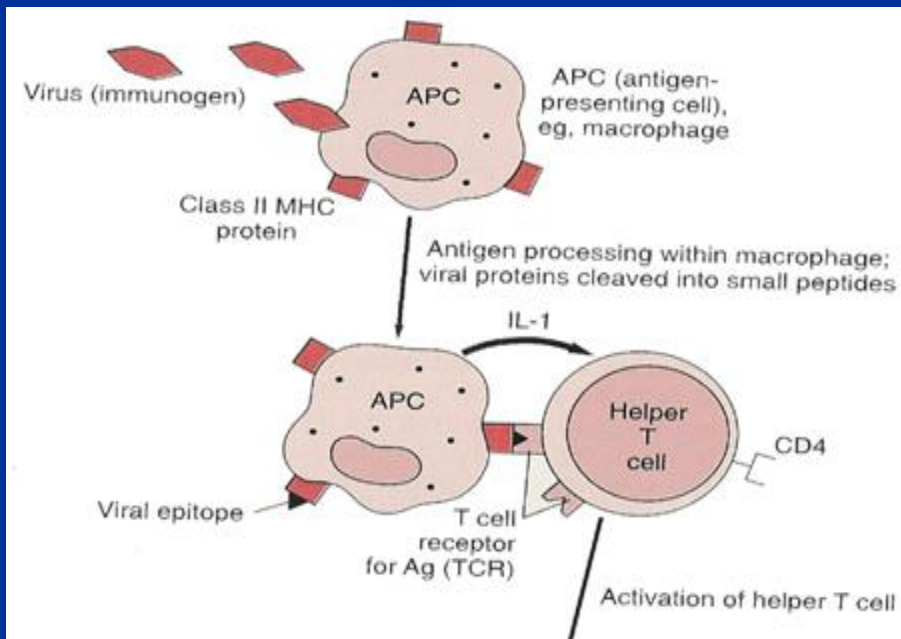
The immune response to virus

❖ Natural killer (NK) cells :

Lysis of VICs

❖ Macrophages:

APC, Cytokines production ,Phagocytosis



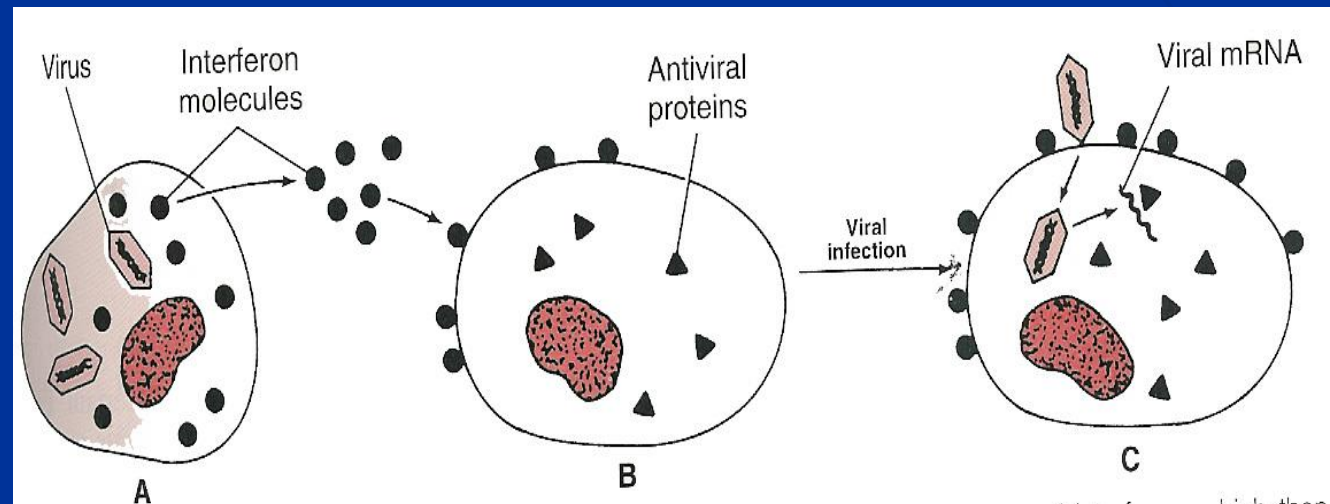
The immune response to virus

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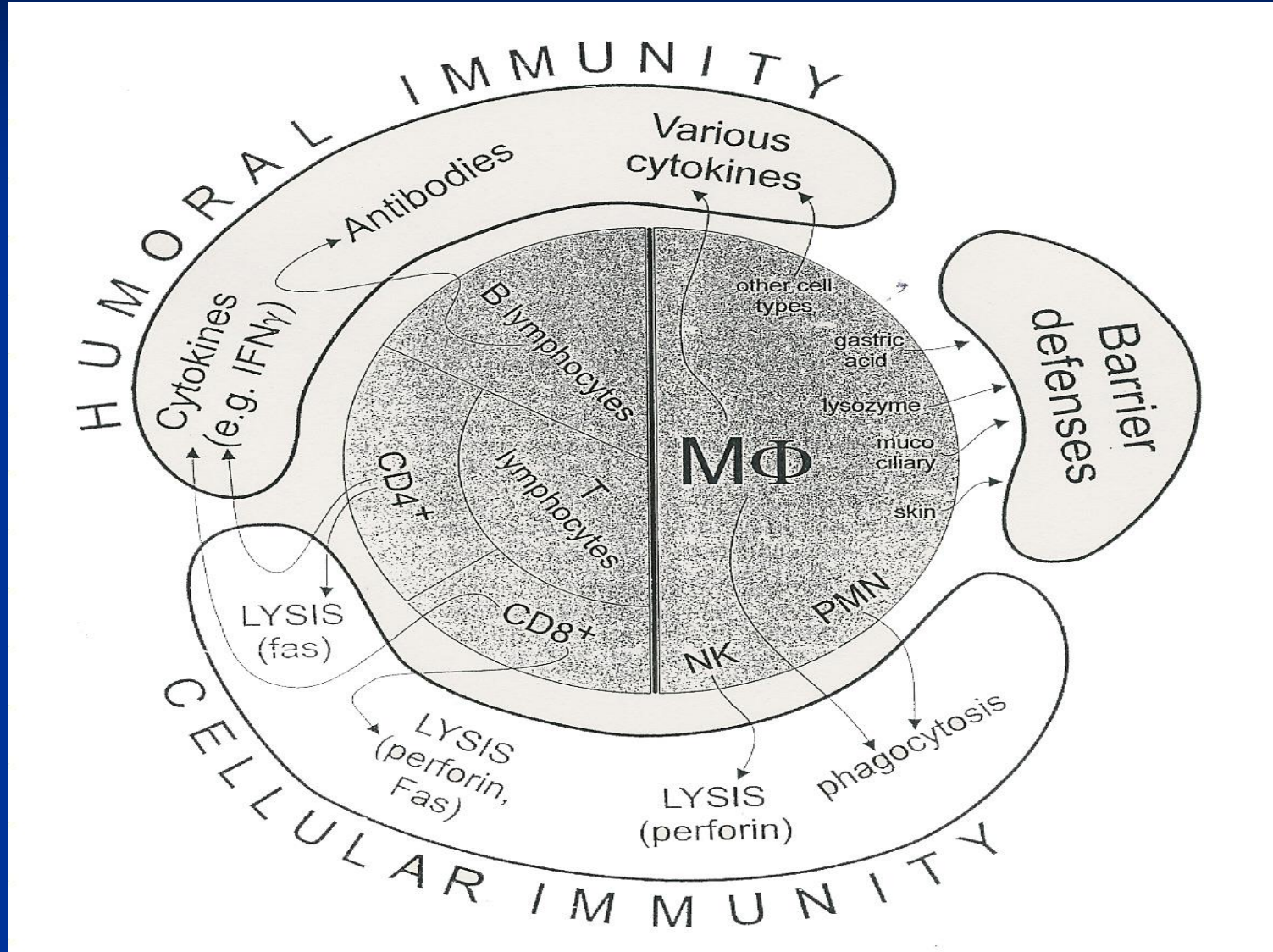
❖ **Cytokines:**

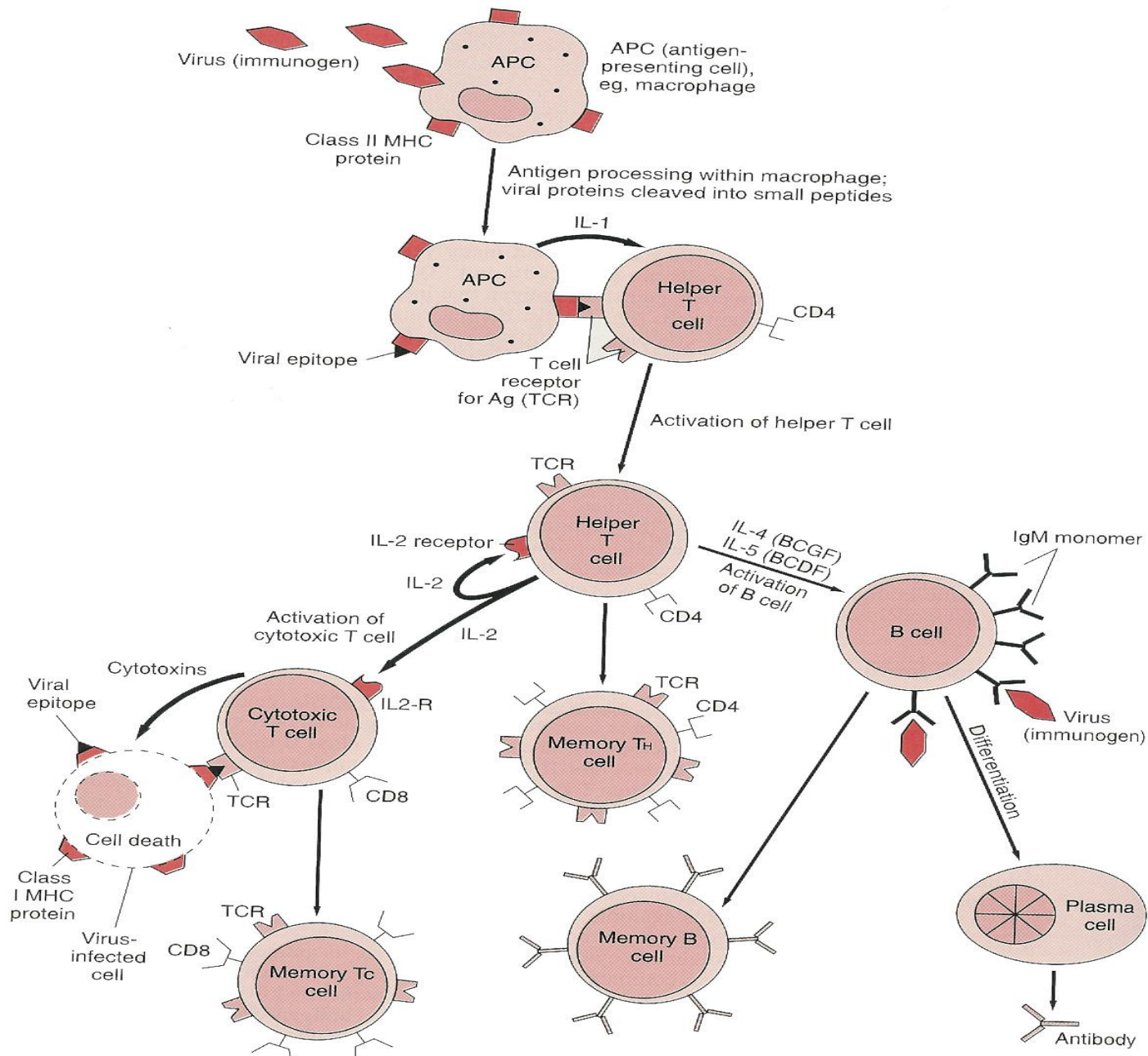
➤ Interferons
(IFN)



- α , β IFN \longrightarrow inhibit viral translation
- γ IFN \longrightarrow stimulate phagocytosis and killing by macrophage & NK cells

The immune response to virus



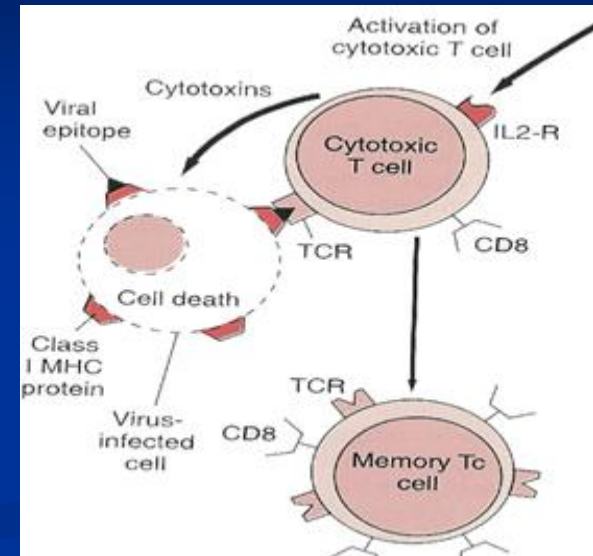


The immune response to virus



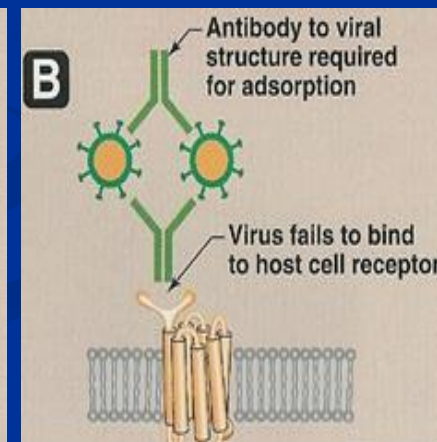
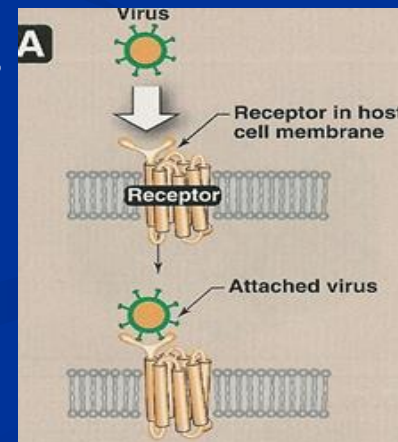
CMI:

- Effective against **intracellular** viruses
- Lysis of virally infected cells
by CTCs [CD8]



Humoral Immunity:

- Effective on **extracellular** viruses
- [viremia]
- Neutralization



The stages of a typical viral infection:

1. The incubation period
2. Prodromal period
3. The specific-illness period:

The signs & symptoms of viral diseases are the result of Cell killing by:

A) Inhibition of cellular macromolecular synthesis

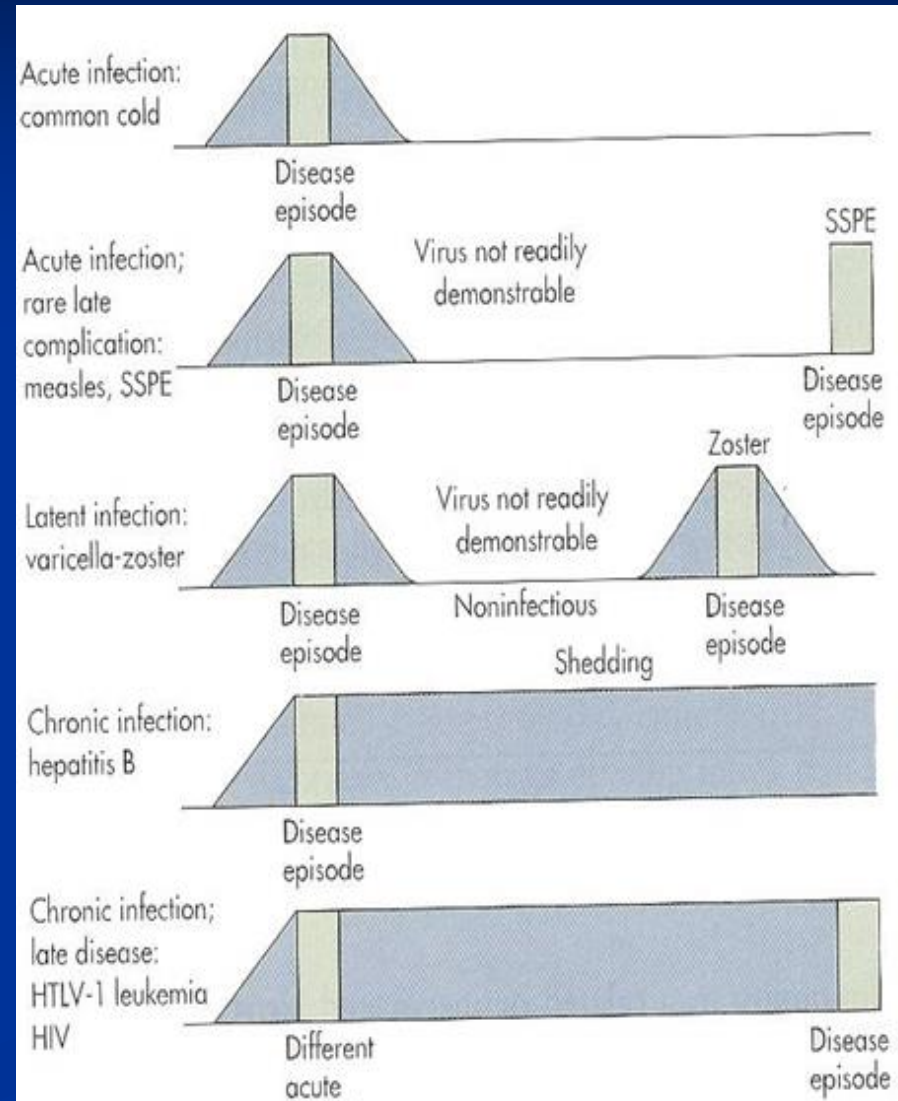
B) Immunologic attack (Immunopathogenesis)

Cytotoxic T cells e.g. Hepatitis (HAV, HBV, HCV)

4. The recovery period

Types of viral infections at host level:

1. Asymptomatic infection
2. Acute infection
3. Persistent infection
 - Late complication of acute infection
 - Latent infection
 - Chronic infection



- **RSV** = Respiratory syncytial virus
- **HAV** = Hepatitis A virus
- **HBV** = Hepatitis B virus.
- **HCV** = Hepatitis C virus
- **HIV** = Human immunodeficiency virus
- **HPV** = Human papillomavirus
- **HSV** = Herpes simplex virus
- **HTLV** = The human T-lymphotropic (leukemia) virus
- **YFV** = Yellow Fever Virus
- **VZV** = Varicella zoster virus

فضل العلم

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خلاصة حكم المحدث: صحيح

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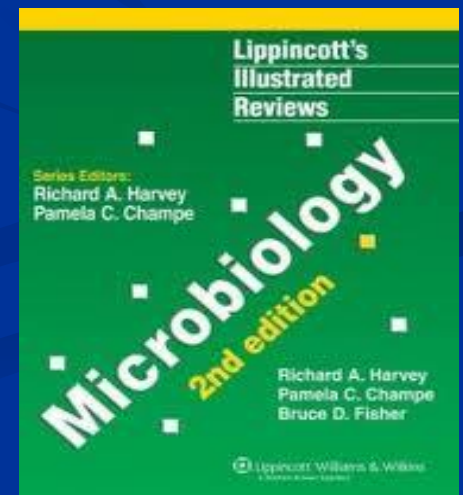
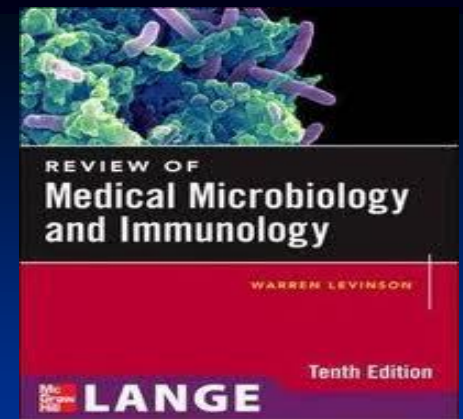
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Pages;221-232
- **Medical Microbiology.**
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By: William A. Strohl ,Harriet Rouse &
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Thank you