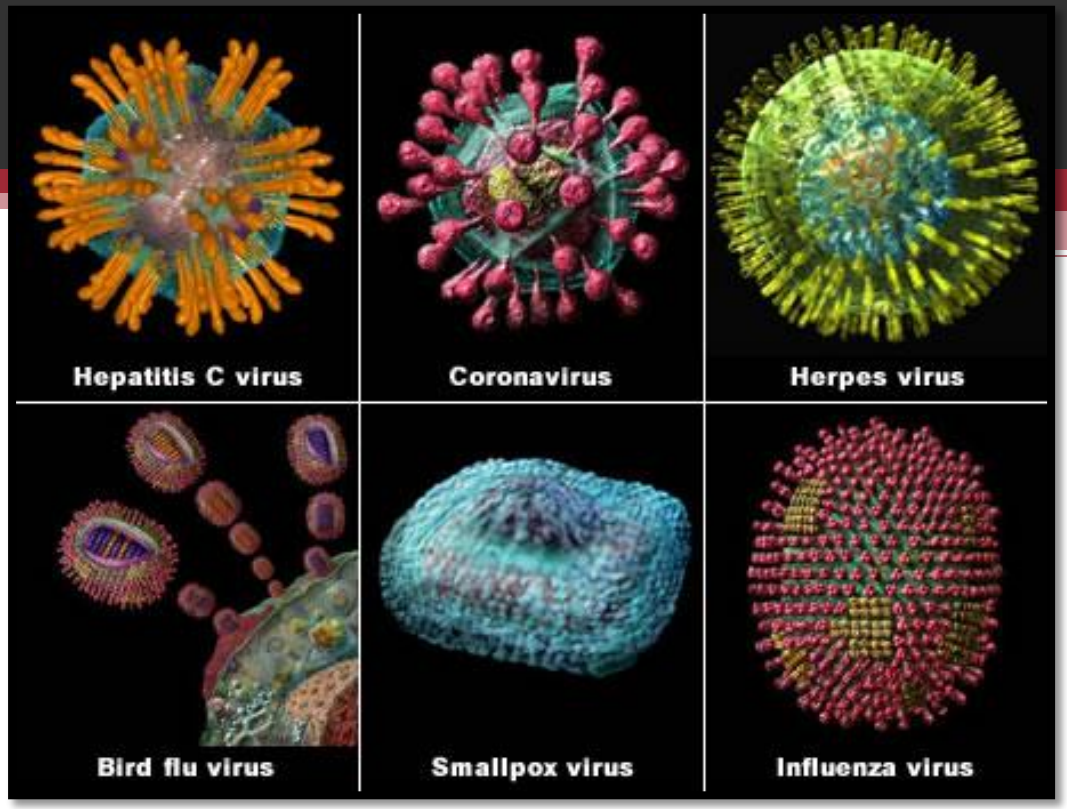
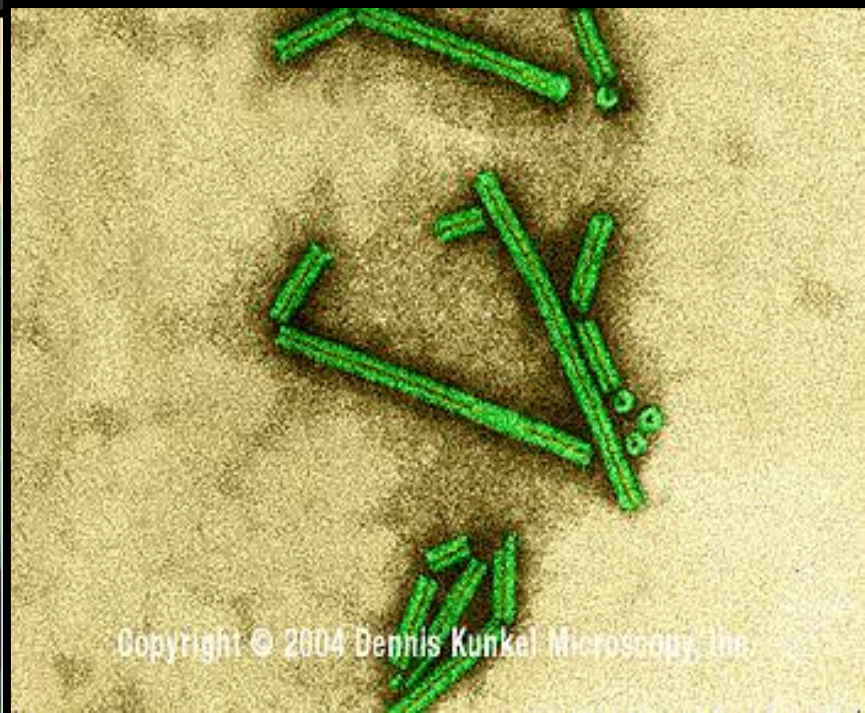
Viral Lesions of the Oral Cavity



Contents:

Introduction

Dimitri Iwanowski discovered of the tobacco mosaic disease (1892)

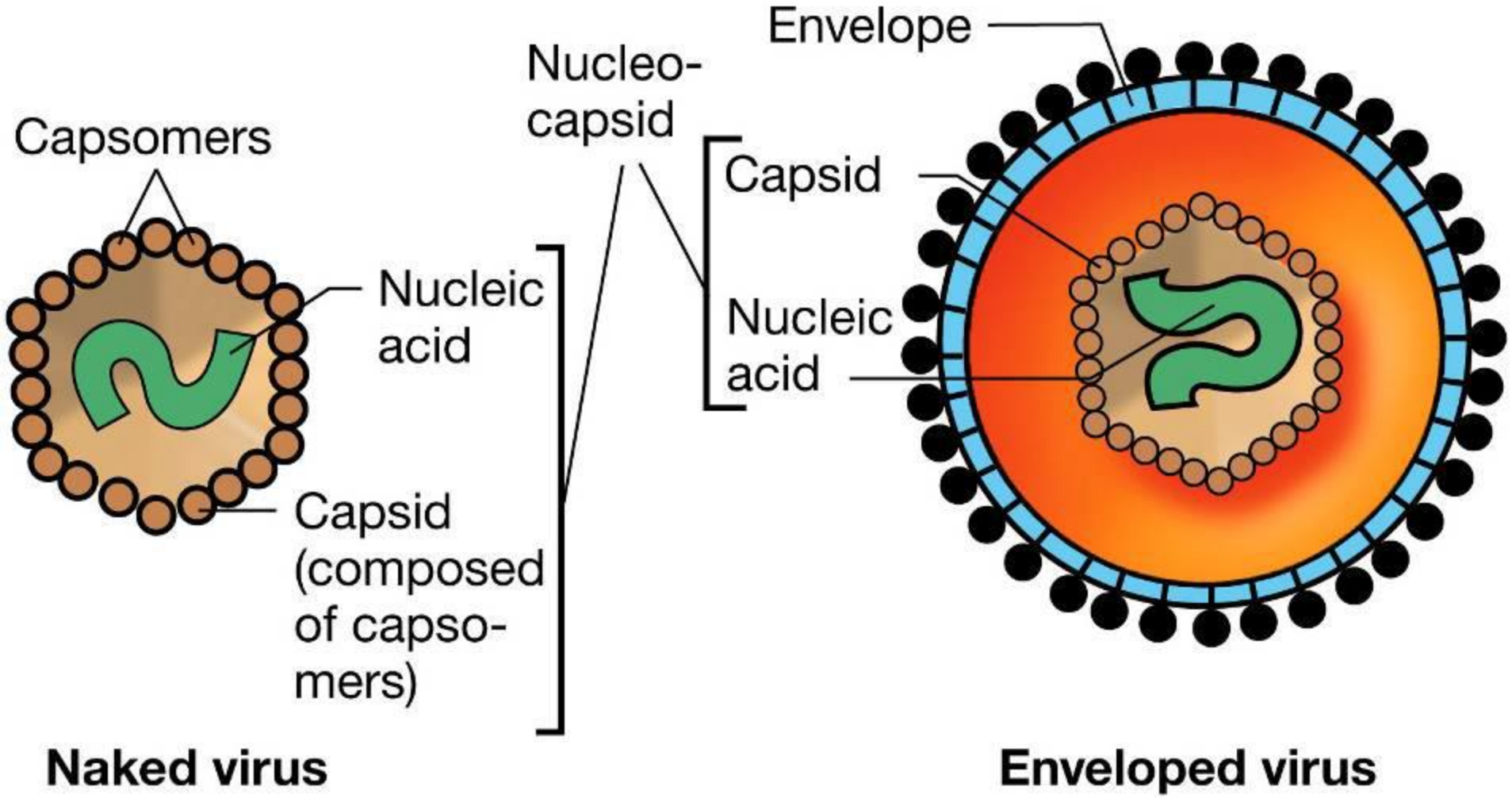


Virus:

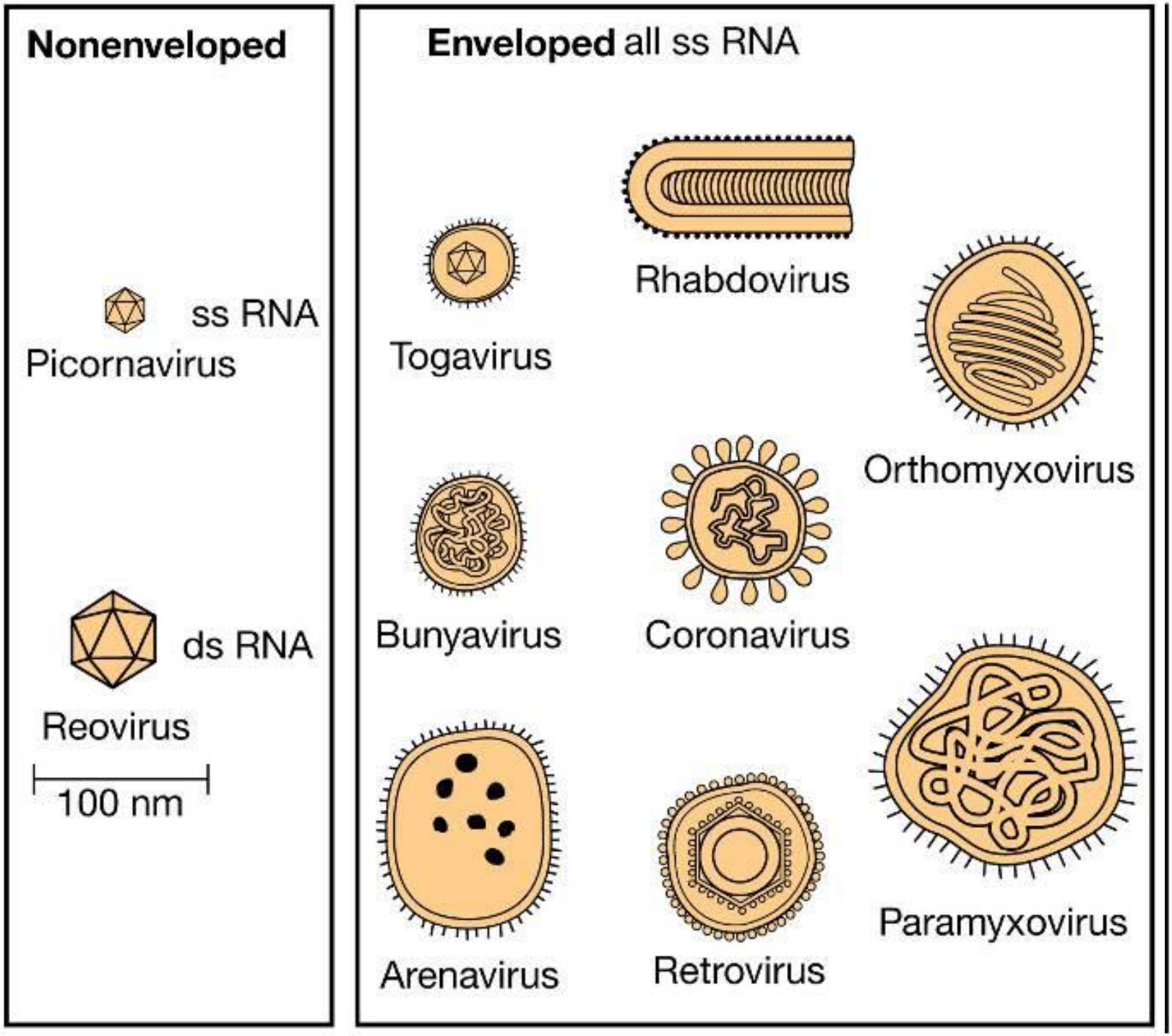
- The *Latin* word "Virus" means "Venom" or "Poison".
- Viruses are ultramicroscopic, metabolically inert & infectious organisms.
- They live & multiply in the living cells.
- Size: Largest is 300nm (poxvirus)
  Smallest 20 nm (parvovirus)

Structure of Viruses

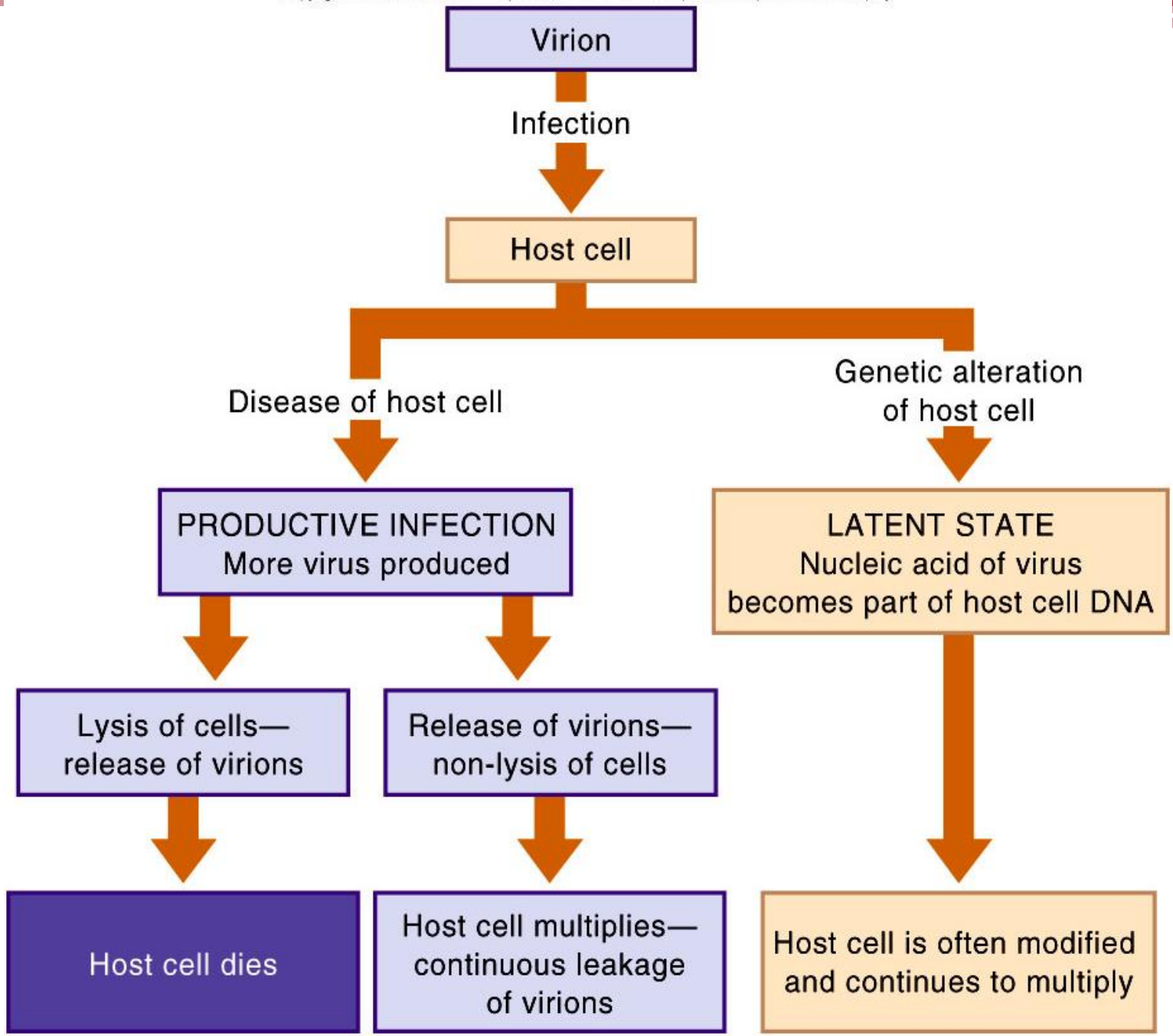
Structure & Shape:



Classification of Viruses


Nonenveloped
ss RNA
Picornavirus
ds RNA
Reovirus
100 nm
Enveloped all ss RNA
Togavirus
Rhabdovirus
Orthomyxovirus
Bunyavirus
Coronavirus
Arenavirus
Retrovirus
Paramyxovirus

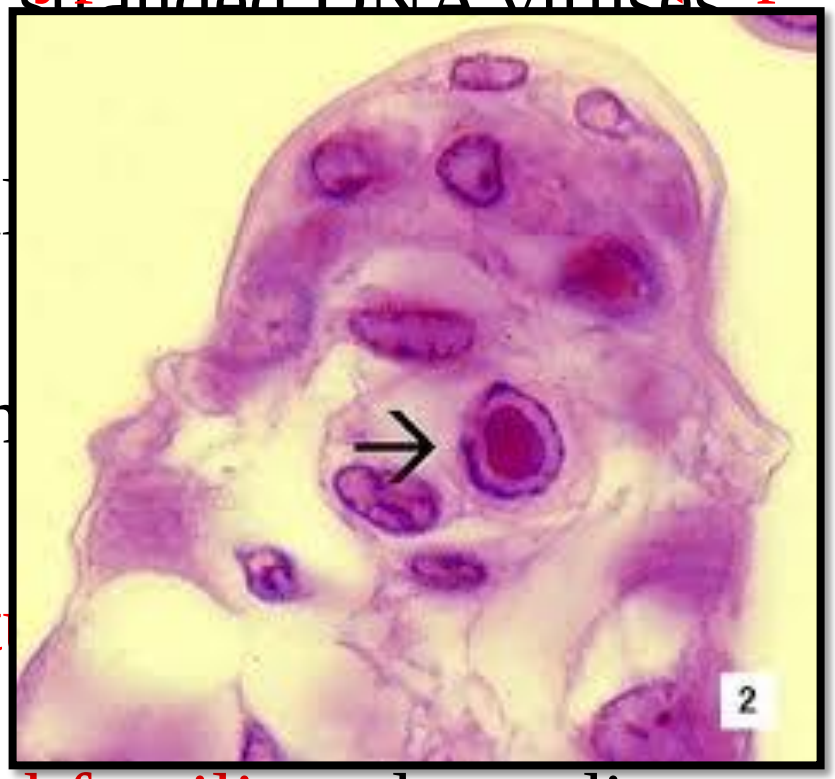
Pathogenesis of Viral Infection


Virion
Infection
Host cell
Disease of host cell
Genetic alteration of host cell
PRODUCTIVE INFECTION
More virus produced
LATENT STATE
Nucleic acid of virus becomes part of host cell DNA
Lysis of cells—release of virions
Release of virions—non-lysis of cells
Host cell dies
Host cell multiplies—continuous leakage of virions
Host cell is often modified and continues to multiply

DNA Viruses: Herpes Viruses

Herpesvirus family:

- They form Cowdry type A intranuclear (Lipschutz) inclusion bodies.
- Enveloped double stranded DNA viruses
- Capsid icosahedral
- They replicate in h
- Characteristic feat



- Divided into 3 subfamilies depending on their biological, physical & genetic properties.

Types of Herpes Virus:

1. Herpes simplex Virus 1
2. Herpes simplex Virus 2
3. Varicella Zoster Virus
4. Cytomegalovirus
5. Epstein-Barr Virus
6. Human Herpes Virus 6
7. Human Herpes Virus 7
8. Human Herpes Virus 8
9. Simian Herpes Virus

Herpes-virus family

Alpha herpes viruses

1. Herpes Simplex
2. Varicella Zoster

Beta herpes viruses

1. Cytomegalovirus
2. HHV 6
3. HHV 7

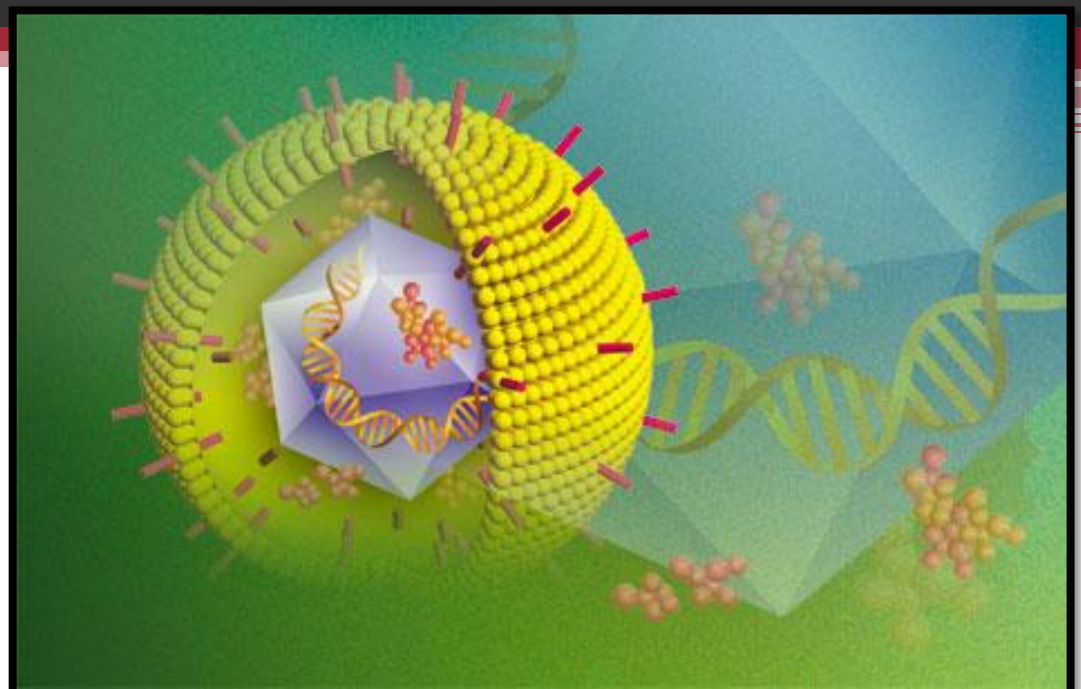
Gamma herpes viruses

1. Epstein-barr
2. HHV 8

8 different types of herpes viruses are known whose primary hosts are humans, called " Human herpes virus types 1-8 "

Official Name	Common Name	Subfamily	Site of latent infection
Human herpes virus type 1	Herpes simplex virus type 1	alpha	Neurons
Human herpes virus type 2	Herpes simplex virus type 2	alpha	Neurons
Human herpes virus type 3	Varicella zoster virus	alpha	Neurons
Human herpes virus type 4	Epstein-barr virus	gamma	Lymphoid tissues
Human herpes virus type 5	Cytomegalovirus	beta	Secretory glands, kidneys
Human herpes virus type 6	Human B cell lymphotropic virus	beta	Lymphoid tissues
Human herpes virus type 7	R K virus	beta	----------
Human herpes virus type 8	----------	gamma	----------

Alpha Herpes Viruses: Herpes Simplex

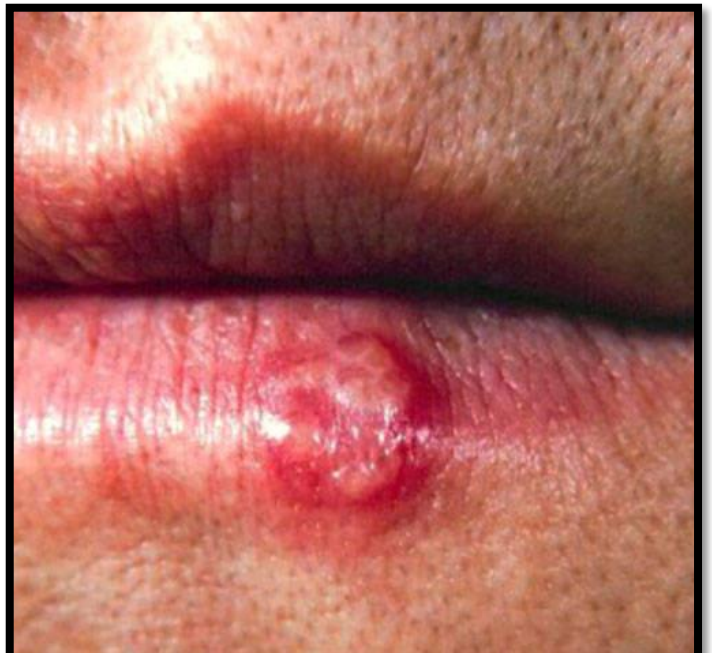


Herpes Simplex: acute infectious disease

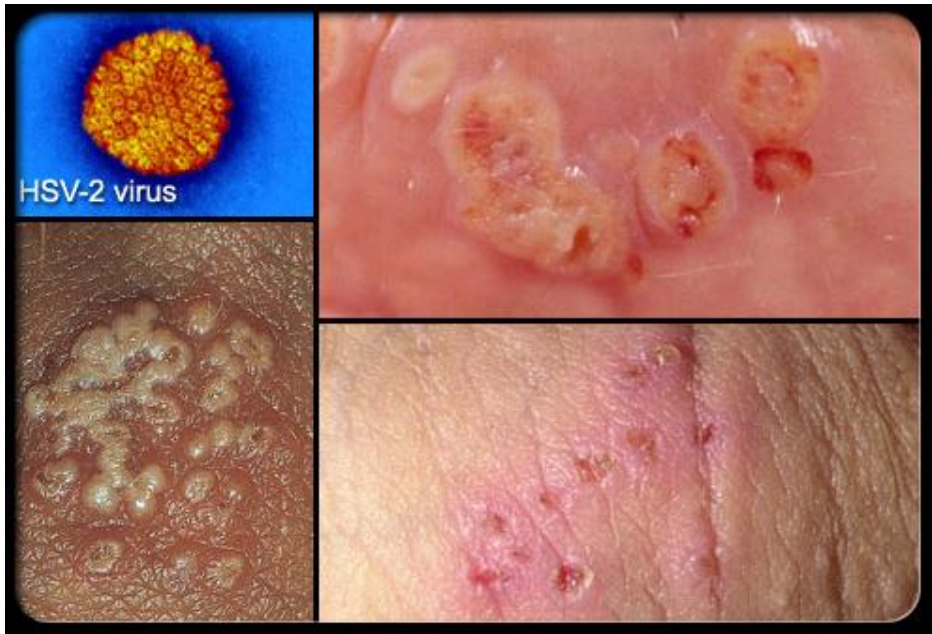
Types

- More virulent
- Carcinoma of Uterine Cervix

HSV type 1

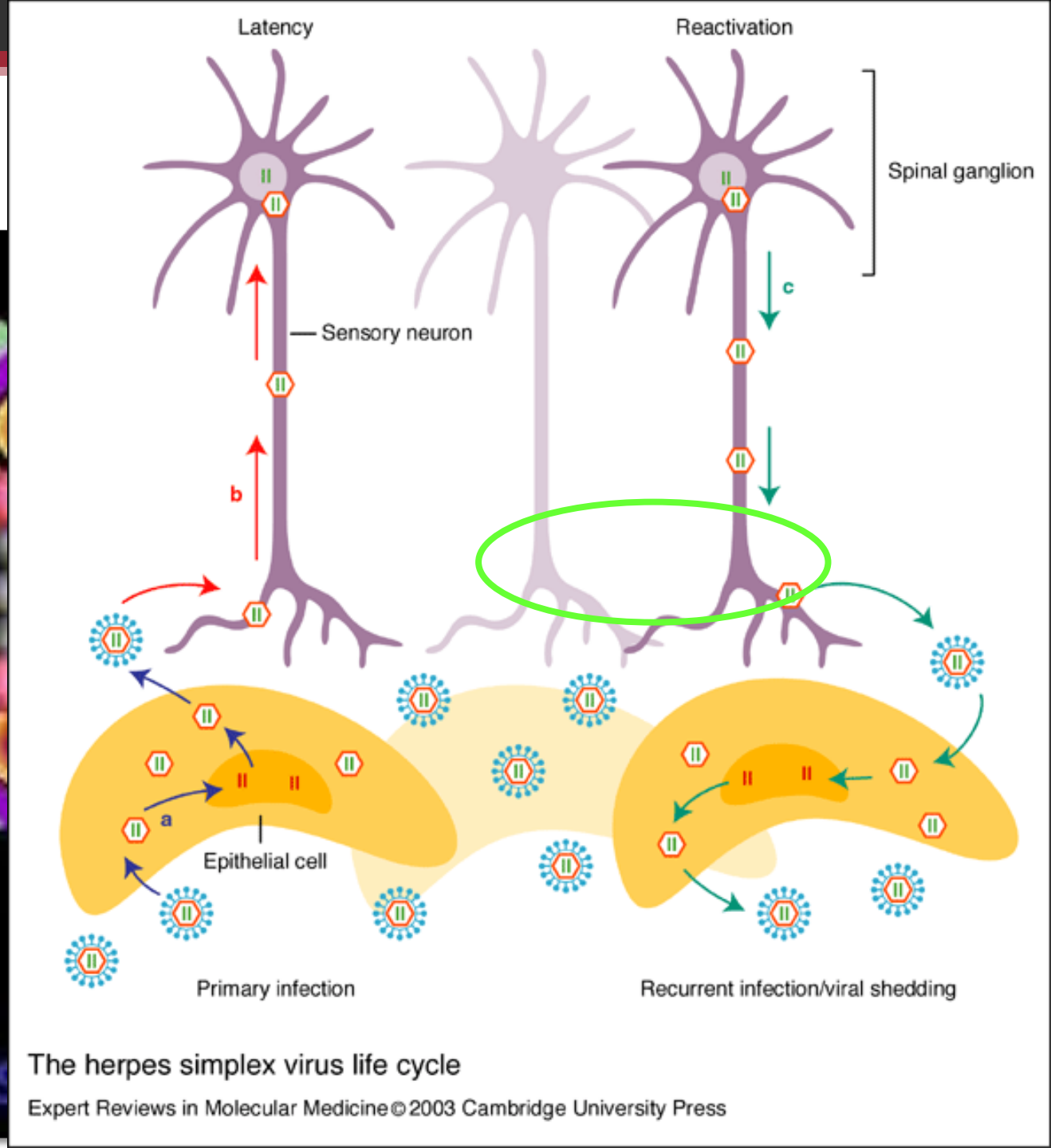


HSV type 2



Structure:

HSV Life cycle:



The herpes simplex virus life cycle

Herpes infection

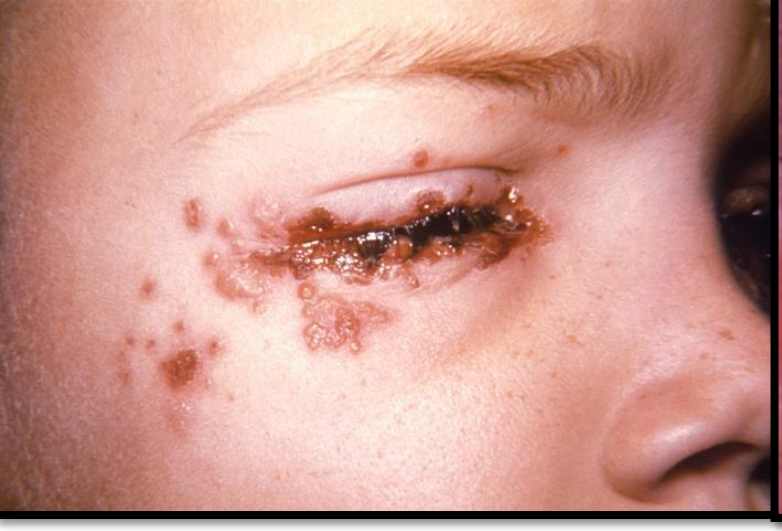
Primary Infection

- No circulating antibodies
- Severe systemic manifestations

Sub-clinical Infection

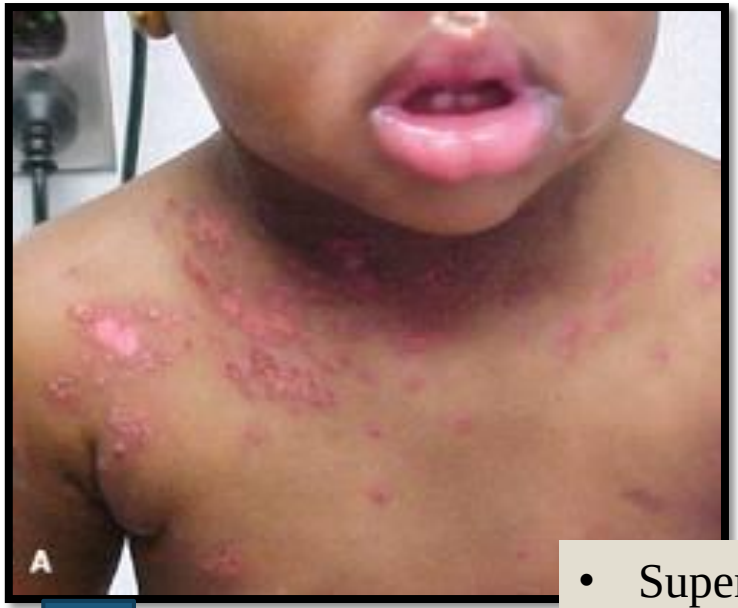
Secondary / Recurrent Infection

- Circulating antibodies



- Swelling & congestion of palpebral conjunctiva
- Corneal lcers
- Vesicles of eyelids

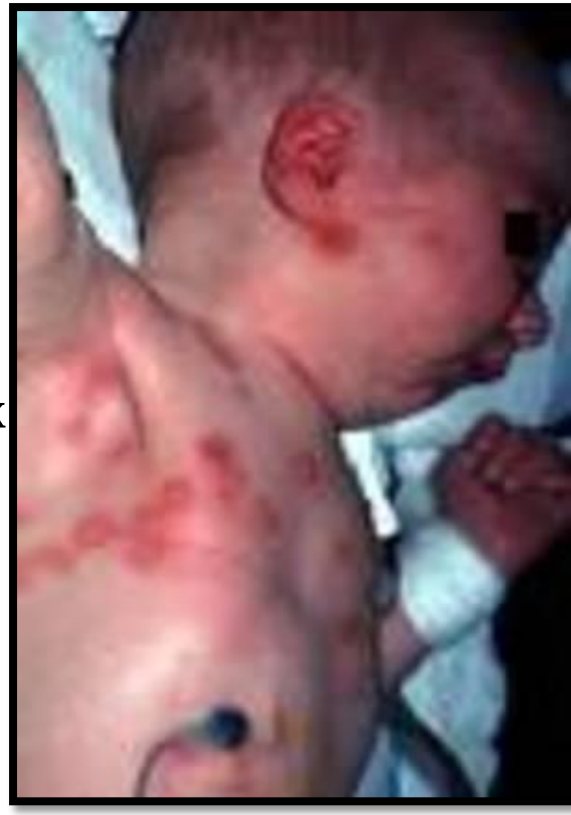
1. Herpetic Conjunctivitis / Keratoconjunctivitis

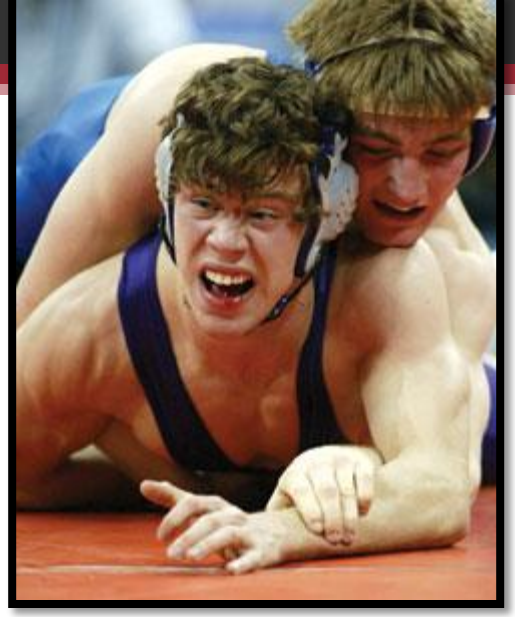


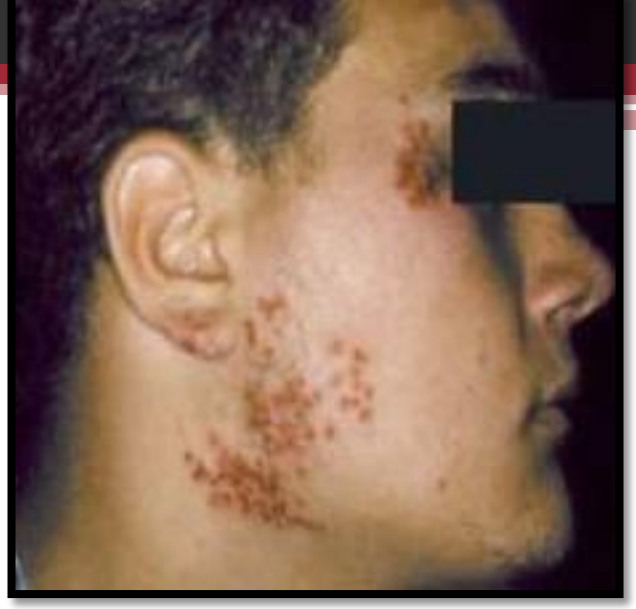
- Superimposed on pre-existing eczema

2. Herpetic Eczema

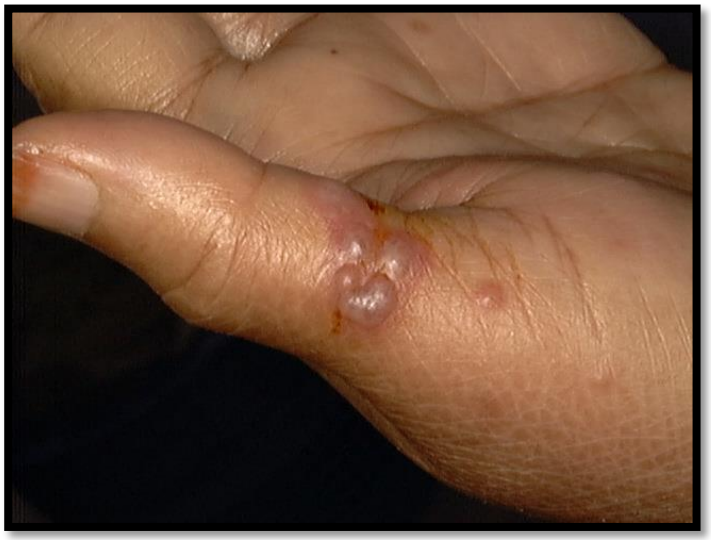
3. Herpes simplex of newborn







4. **Herpetic gladiatorum**

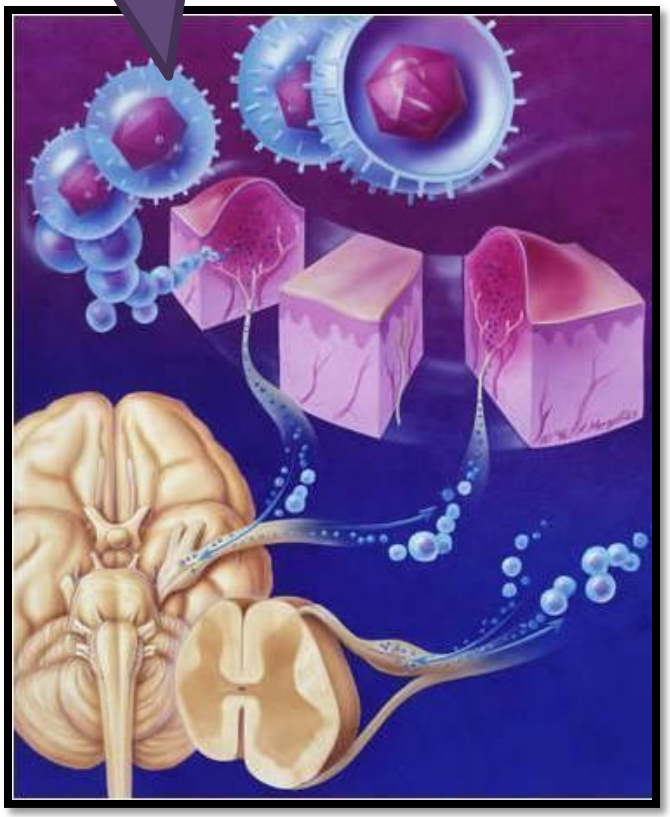


5. **Herpetic whitlow**

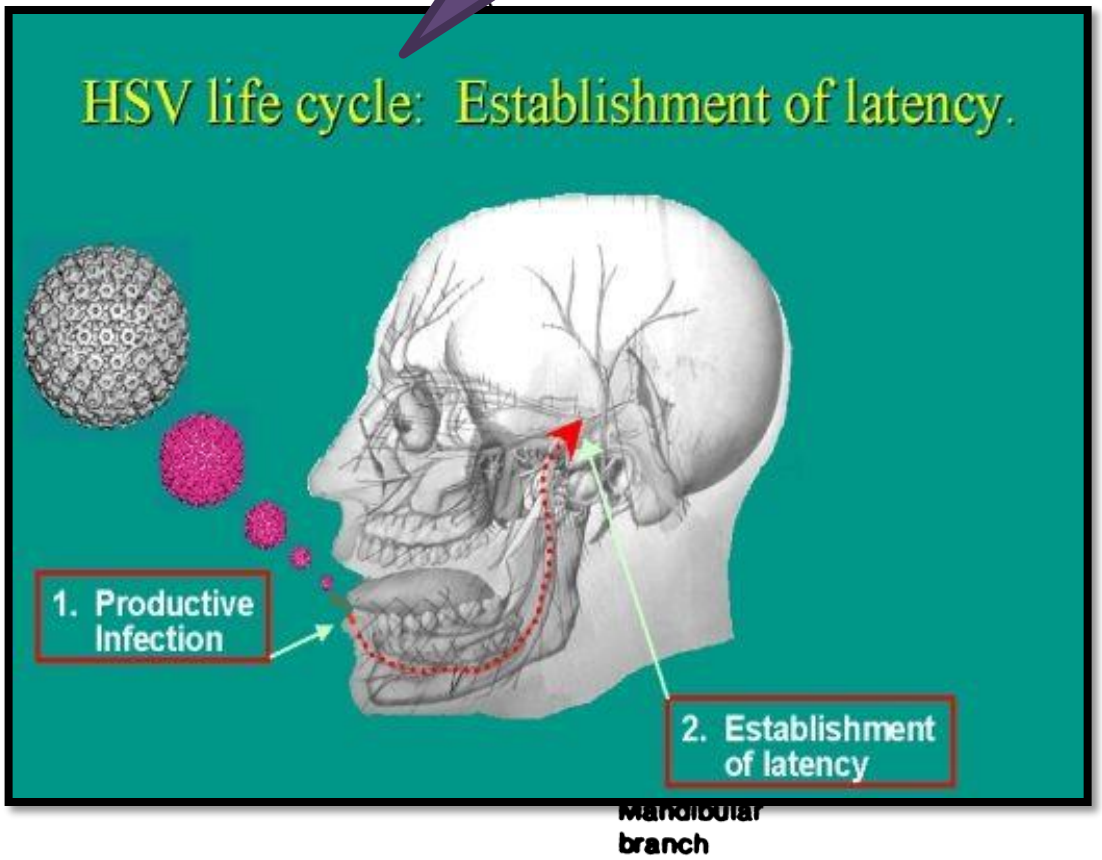
6. **Herpetic meningo-encephalitis:** sudden fever, increased intracranial pressure, paralysis, death

Primary Herpetic Gingivostomatitis

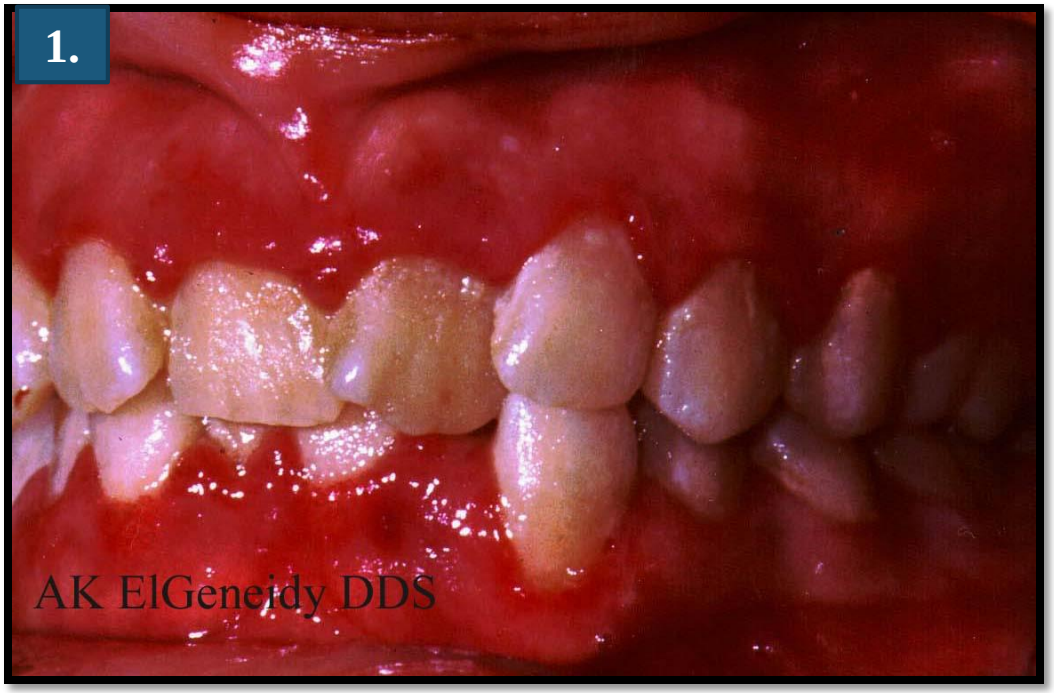
Etiology: HSV I

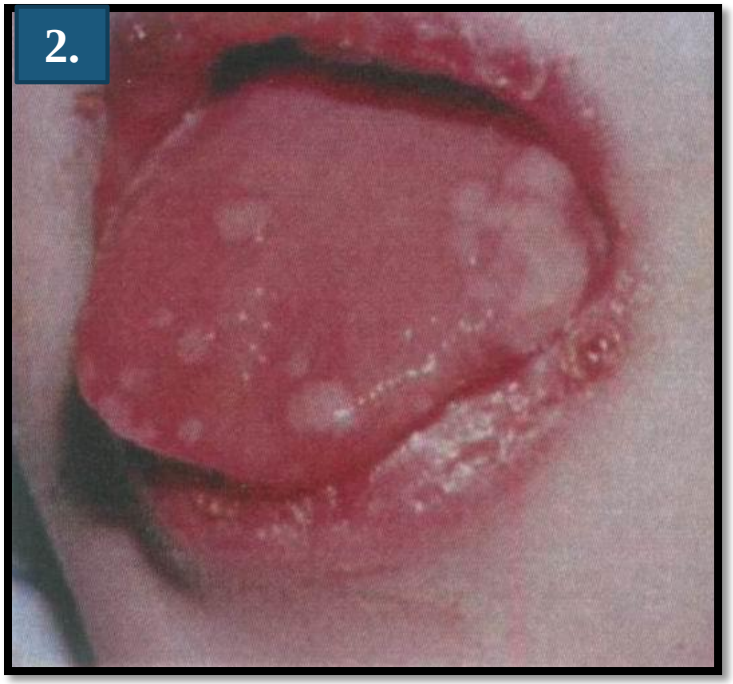


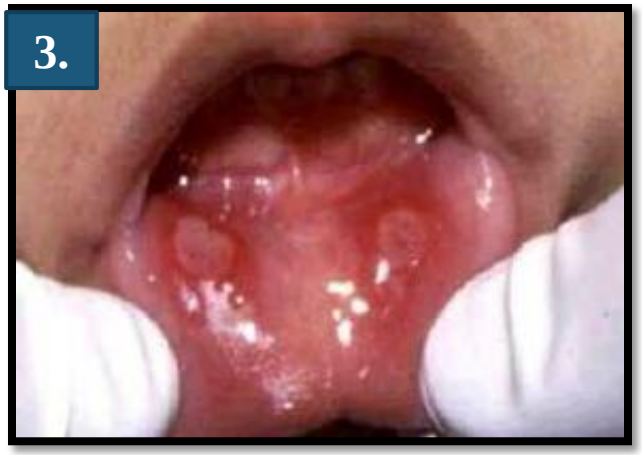
Pathogenesis



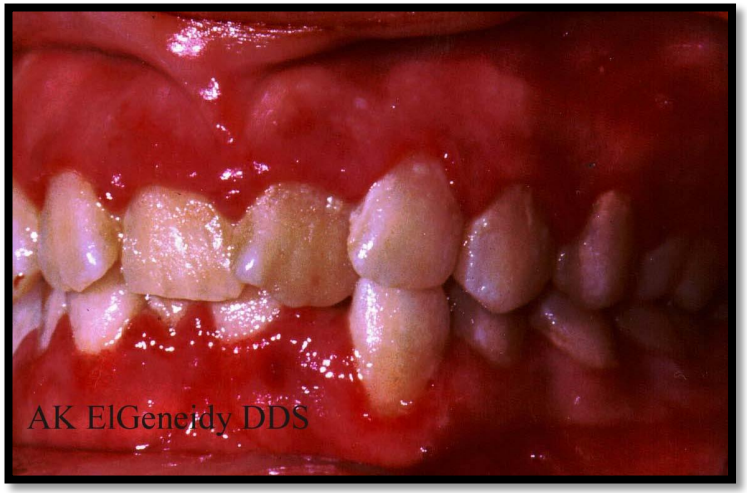
Seen in children & young adults



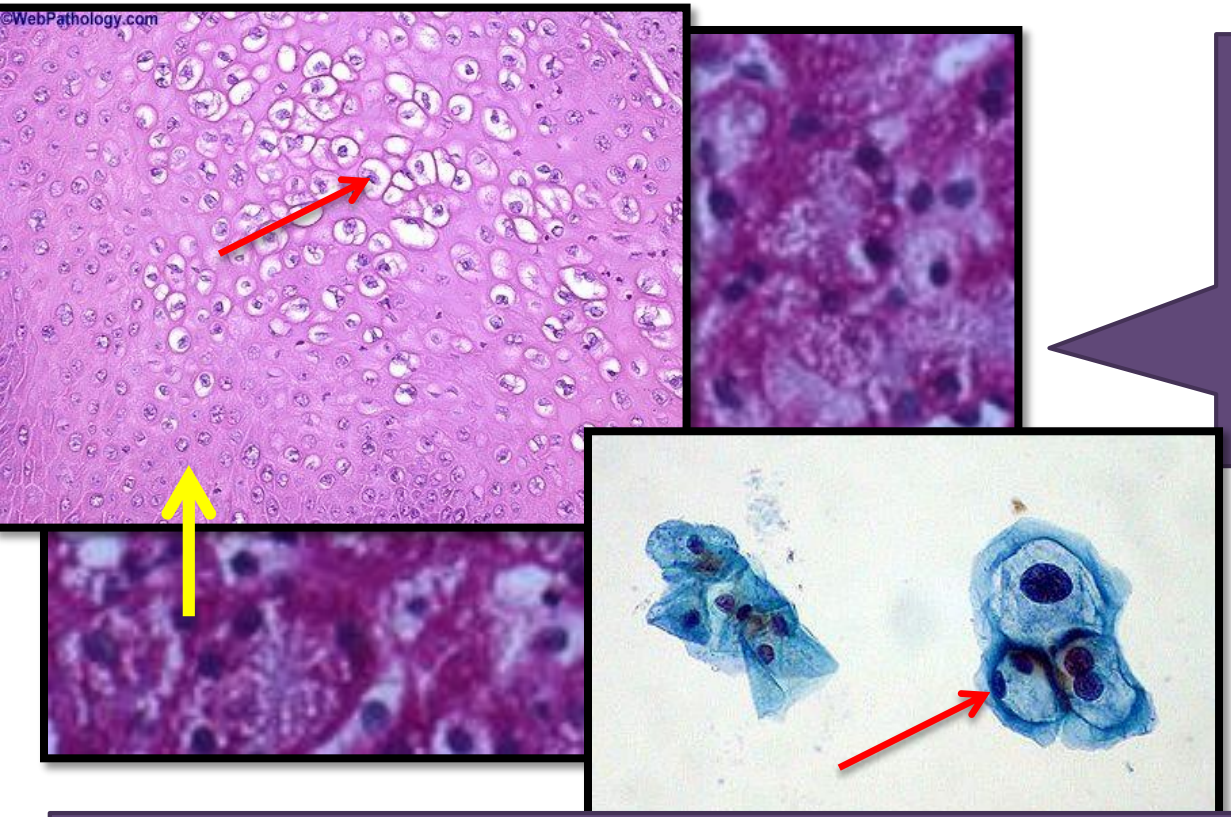




- Fever, irritability, headache, pain on swallowing, regional lymphadenopathy
- Mouth becomes painful
- Gingiva– inflammed, oedematous
- Yellowish fluid filled blisters develop
- They rupture to leave small, ragged, painful ulcers covered by gray membrane
- Surrounding erythematous halo
- Heal without scarring



Primary Herpetic Gingivostomatitis



Histo-pathological features:

- Ballooning degeneration
- Tzanck cells

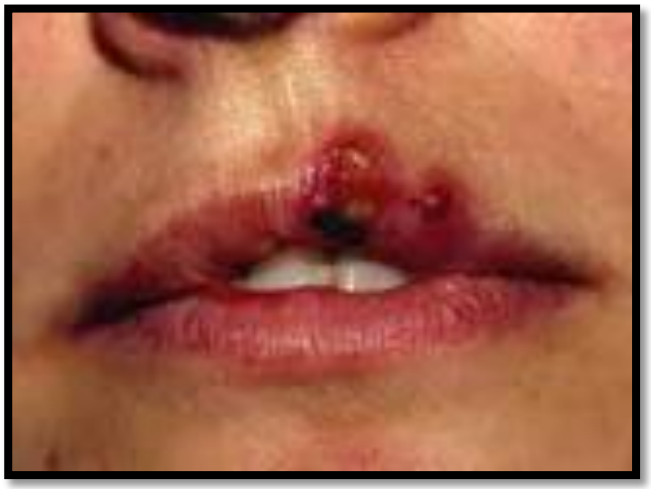
- **Herpetic vesicle is in intra-epithelial fluid filled blister.**
- **Infected cells swollen, pale cytoplasm & large vesicular nucleus termed as "BALLOONING DEGENERATION"**
- **Intra-nuclear inclusions "LIPSCHTUZ BODIES"**

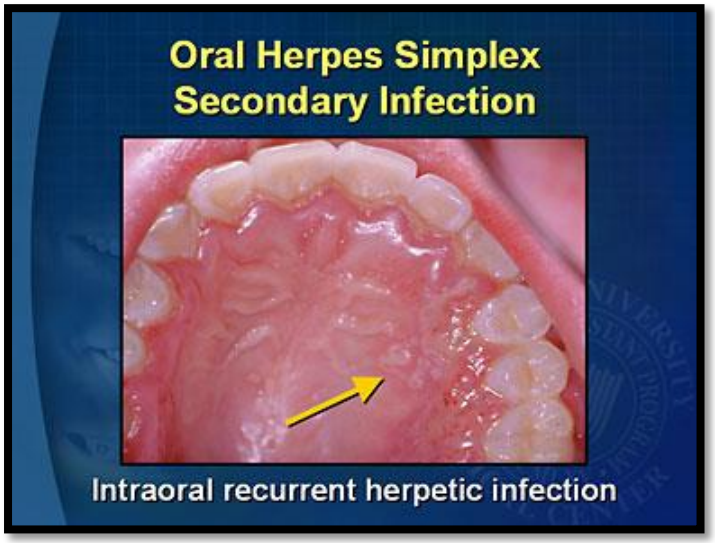
Recurrent or Secondary Herpetic Labialis & Stomatitis:

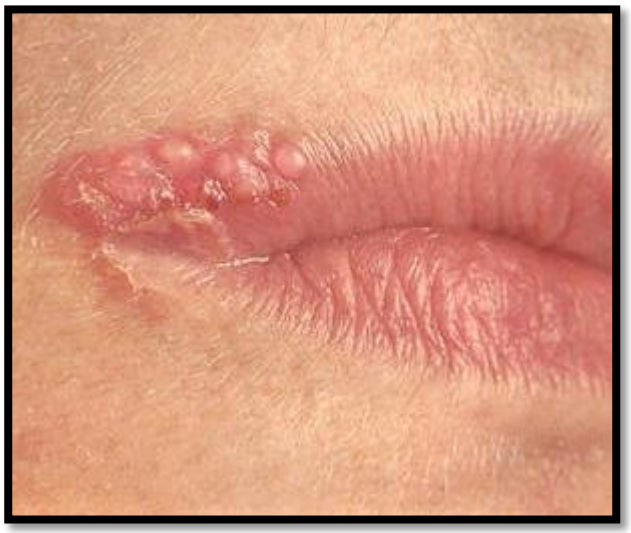
- **Trigger factors:**

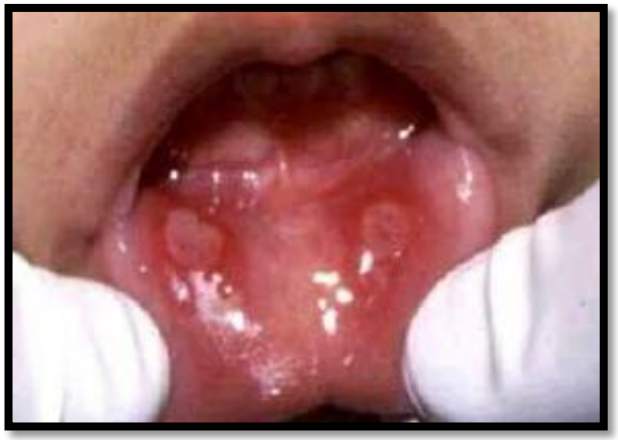
- Trauma
- Fatigue
- Menstruation, Pregnancy
- URTI
- Emotional upset
- Allergy

Recurrent or Secondary Herpetic Labialis & Stomatitis:









Alpha Herpes Viruses: Varicella Zoster

- **First isolated by Weller**

- **Von Bokay in 1889, Varicella & Herpes Zoster are different manifestations of the same virus infection.**

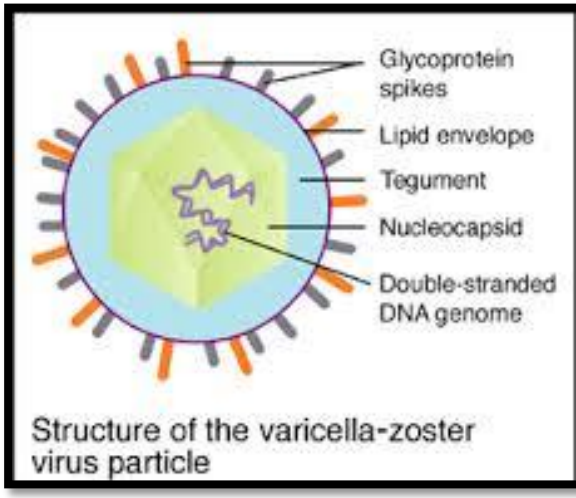
- Varicella (Chickenpox) & herpes zoster are manifestations of the same virus infection, so the virus is called "Varicella Zoster".

Chickenpox

Primary infection in non-immume individual

Herpes zoster

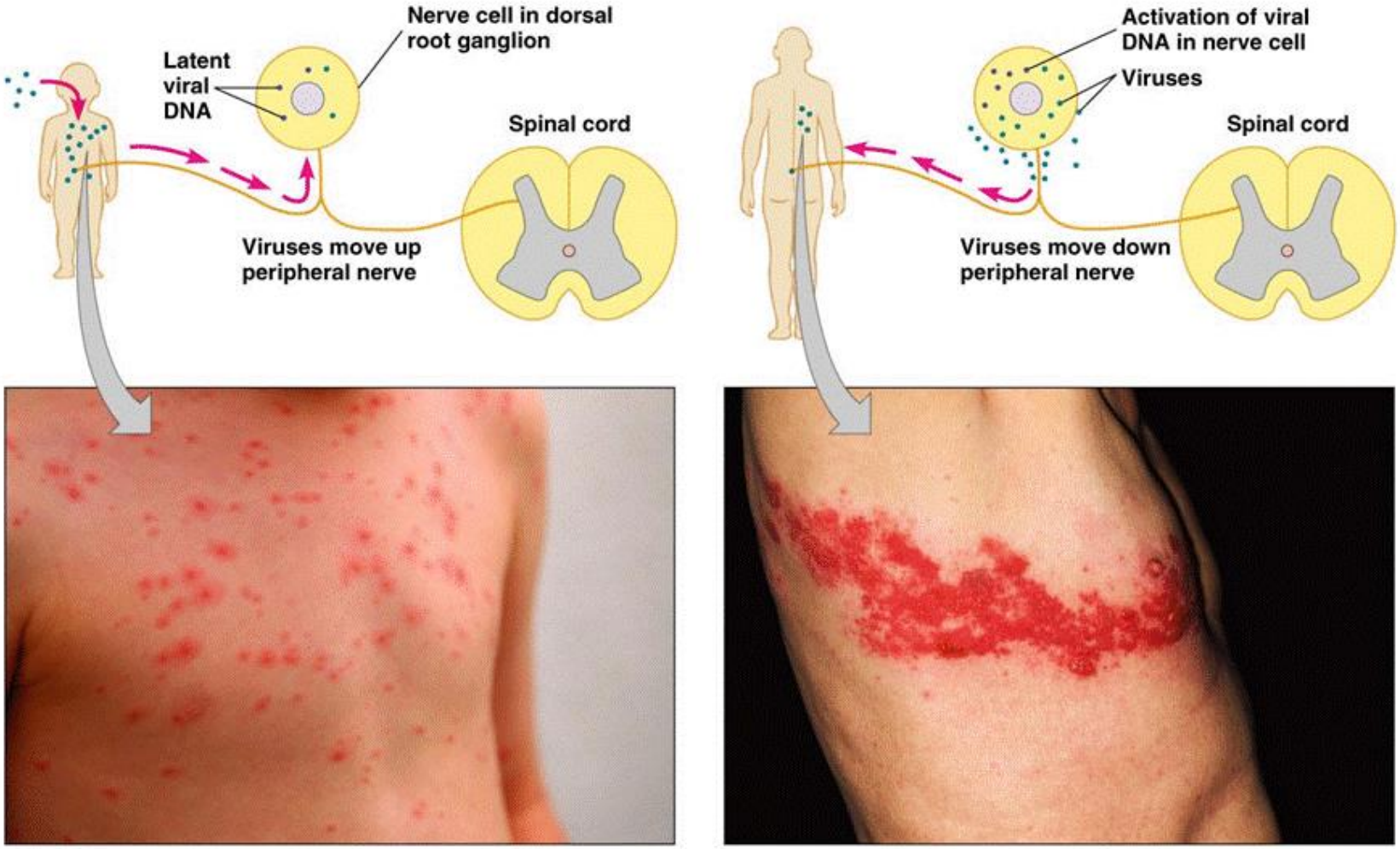
Reactivation of latent virus with decrease in immunity



Structure of the varicella-zoster virus particle

- Contact with either zoster or chickenpox may lead to chickenpox & not zoster.

Primary infection with

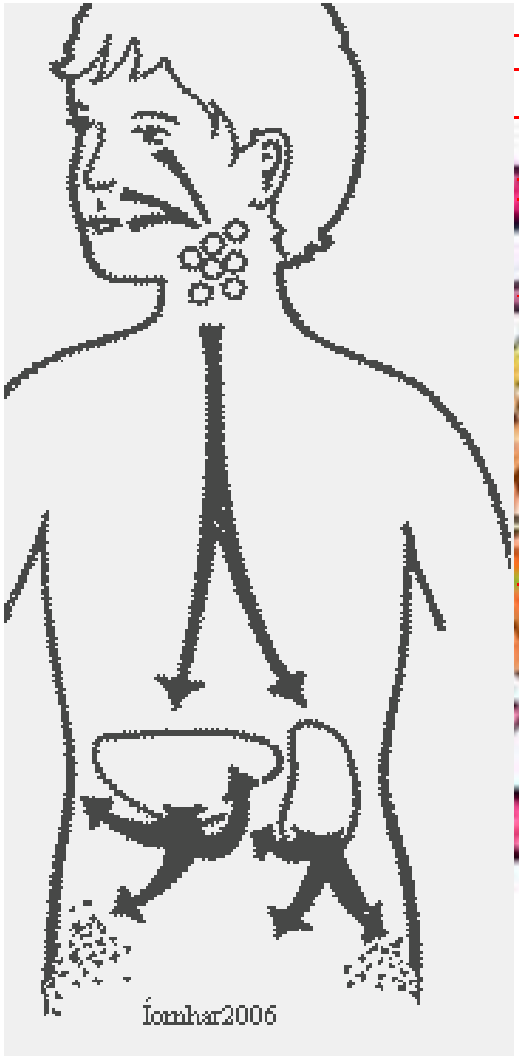


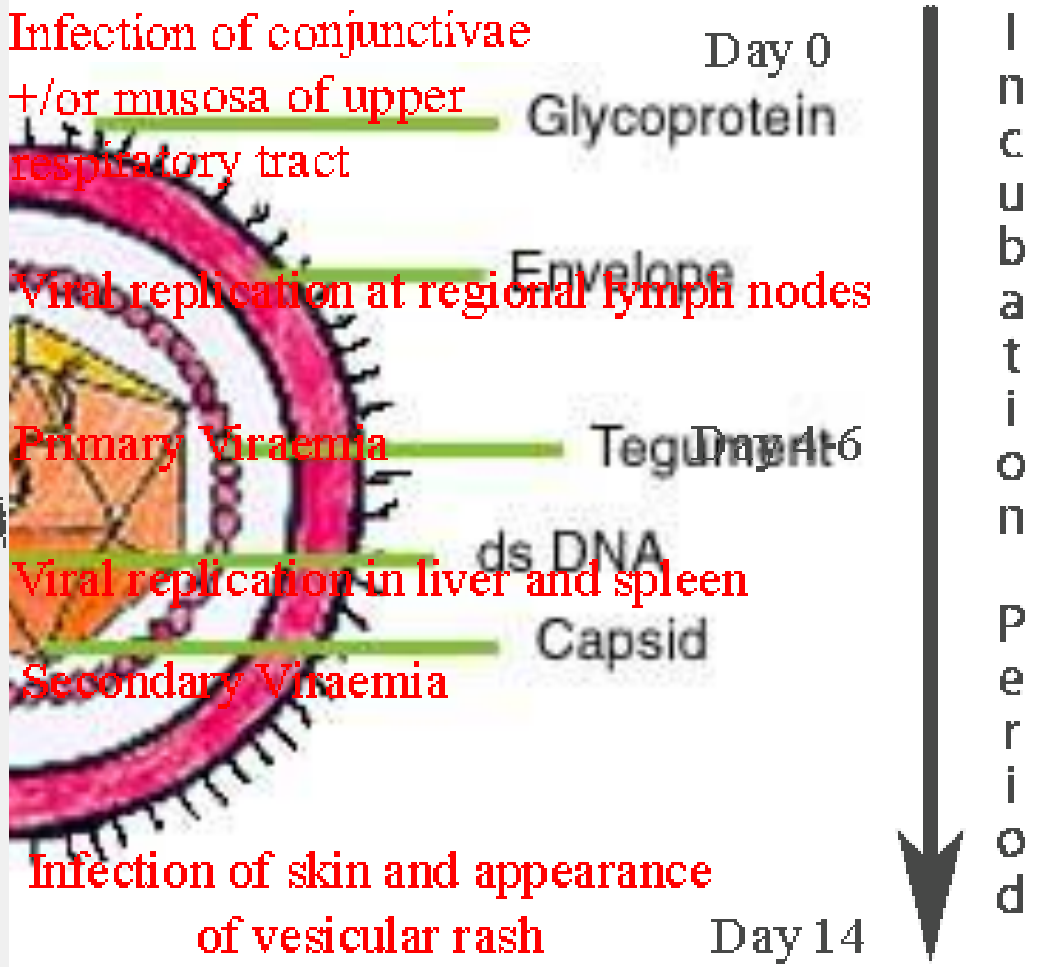
(a) Initial infection: chickenpox (varicella)

(b) Recurrence of infection: shingles (herpes zoster)

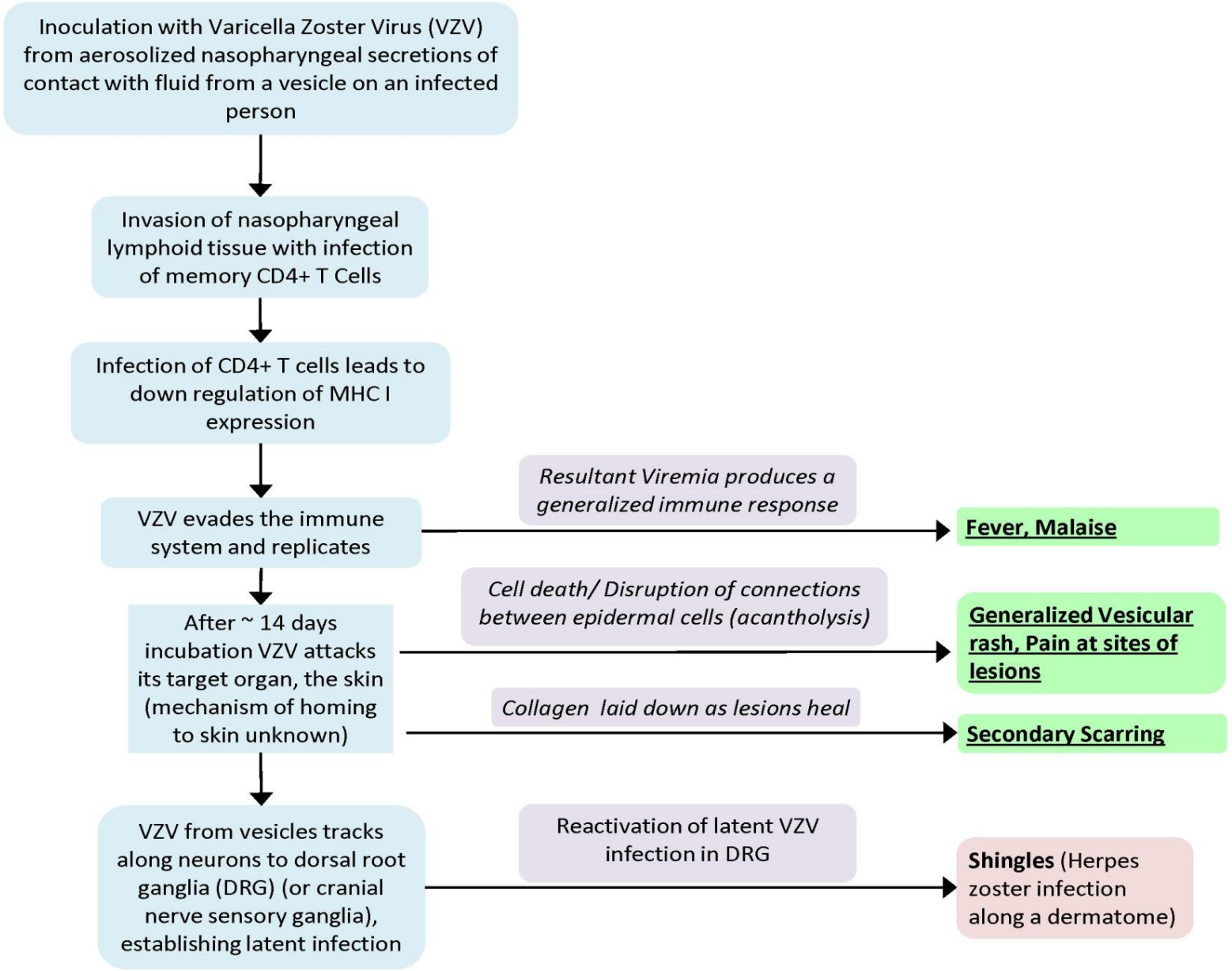
Chickenpox (Varicella):

Acute, contagious disease





Varicella Zoster - Chicken Pox: *Pathogenesis and clinical findings*



Legend: Pathophysiology | Mechanism | Sign/Symptom/Lab Finding | Complications

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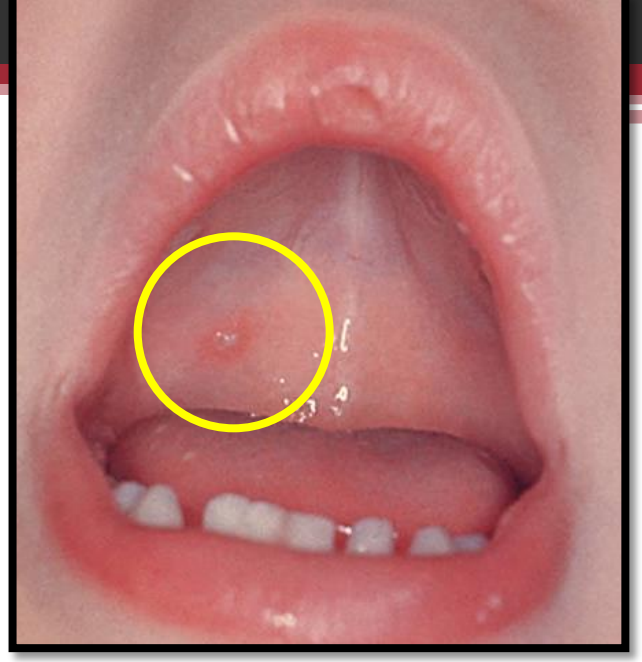
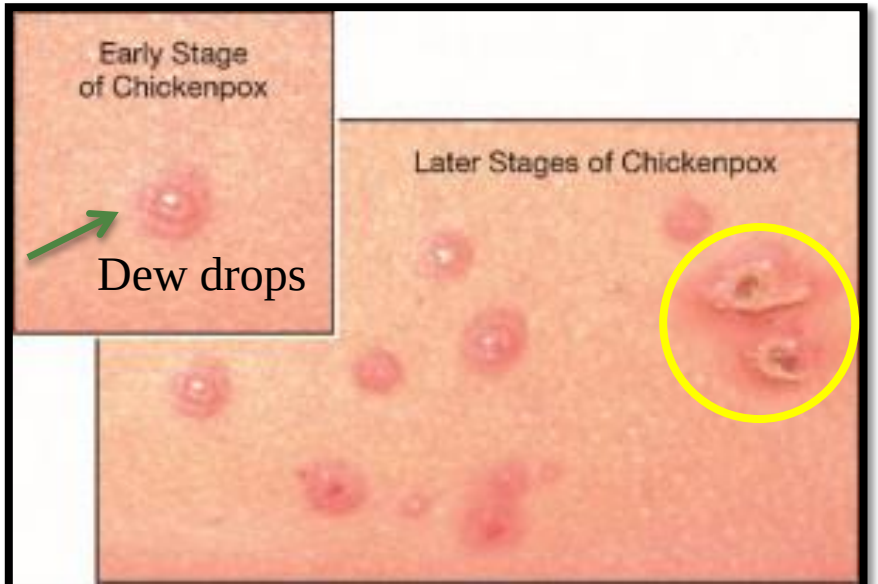
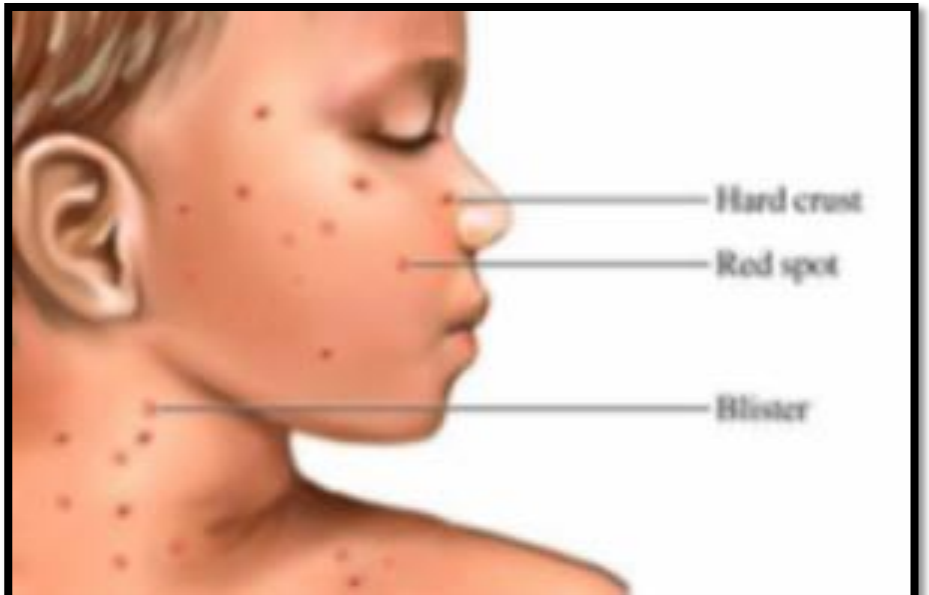
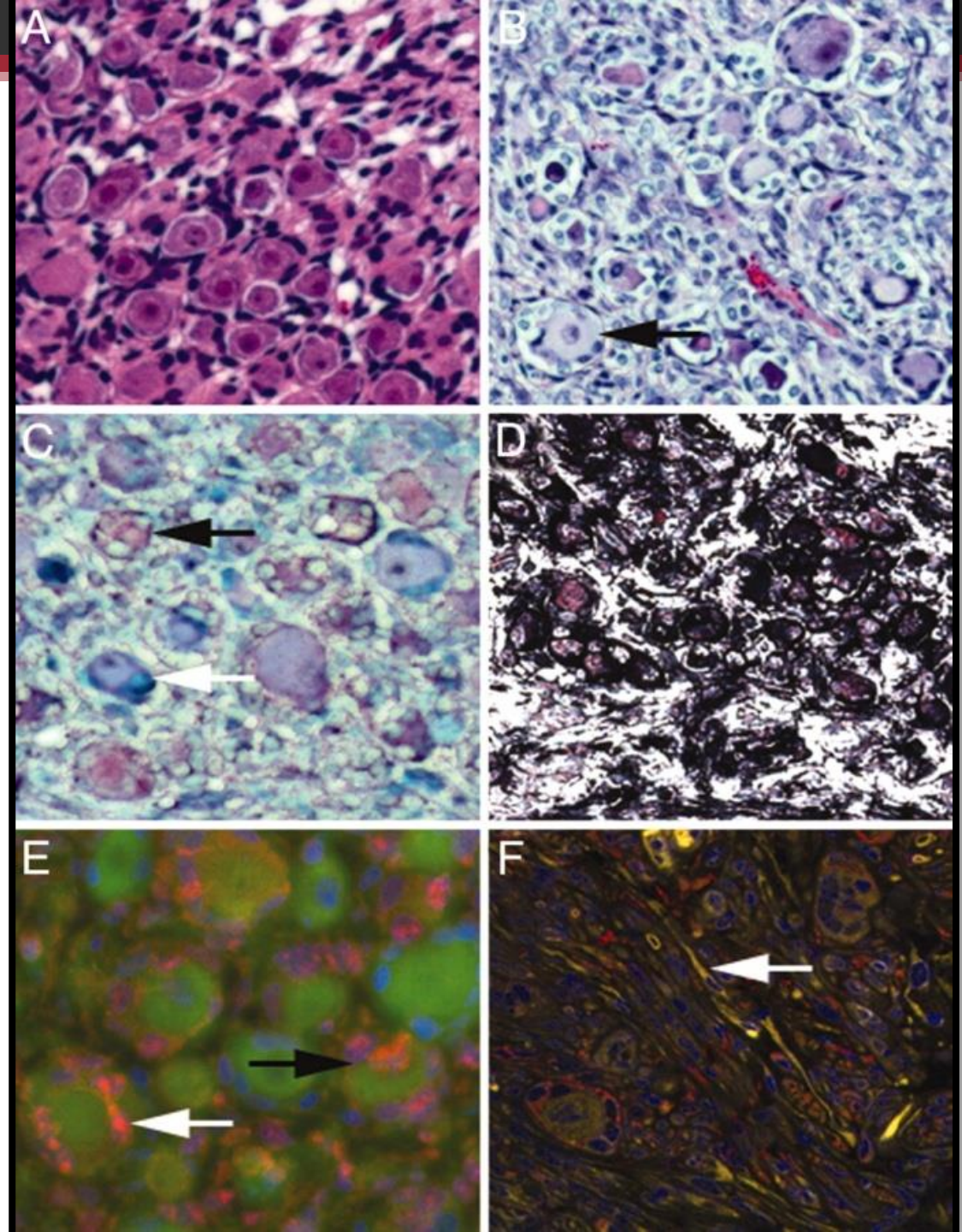


Infectious: 2 days before & 5 days after the onset of lesions

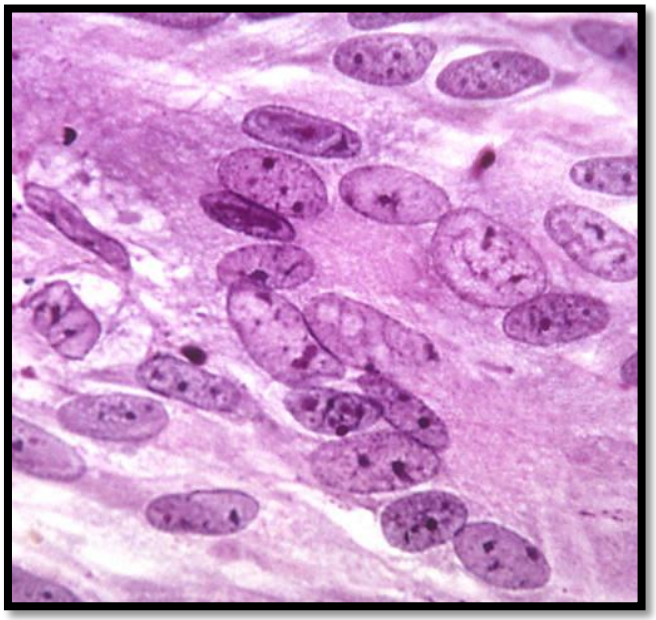






- **Multi-nucleated giant cells.**

- **Cowdry Type A intra-nuclear inclusion bodies.**



Varicella vaccine:

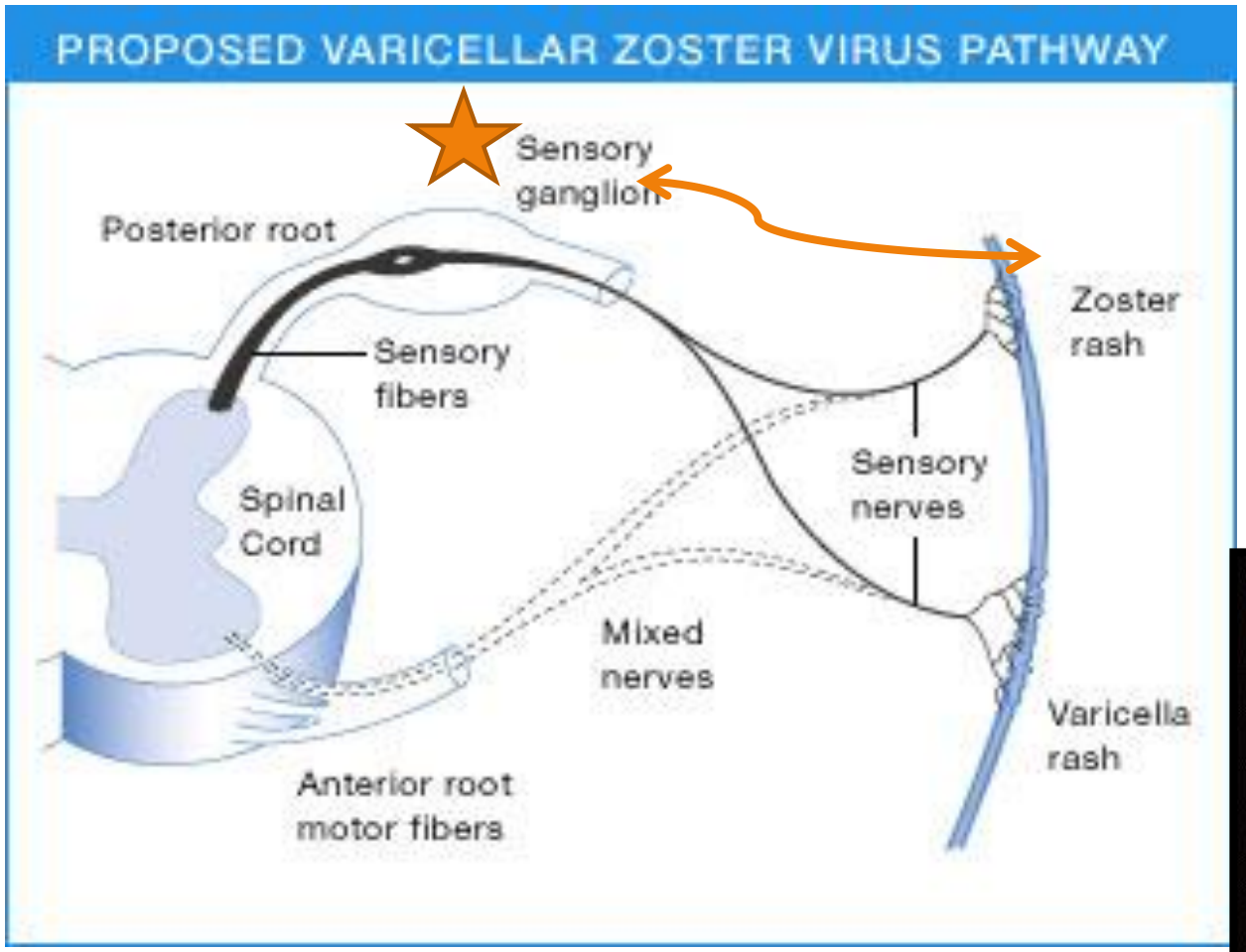
Children: 1-12 yrs – a single dose

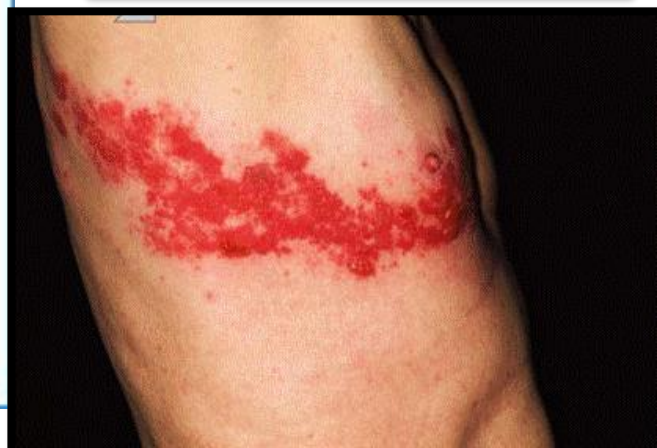
Adults: 2 doses, 6-10 weeks apart

Herpes Zoster: Shingles, Zona

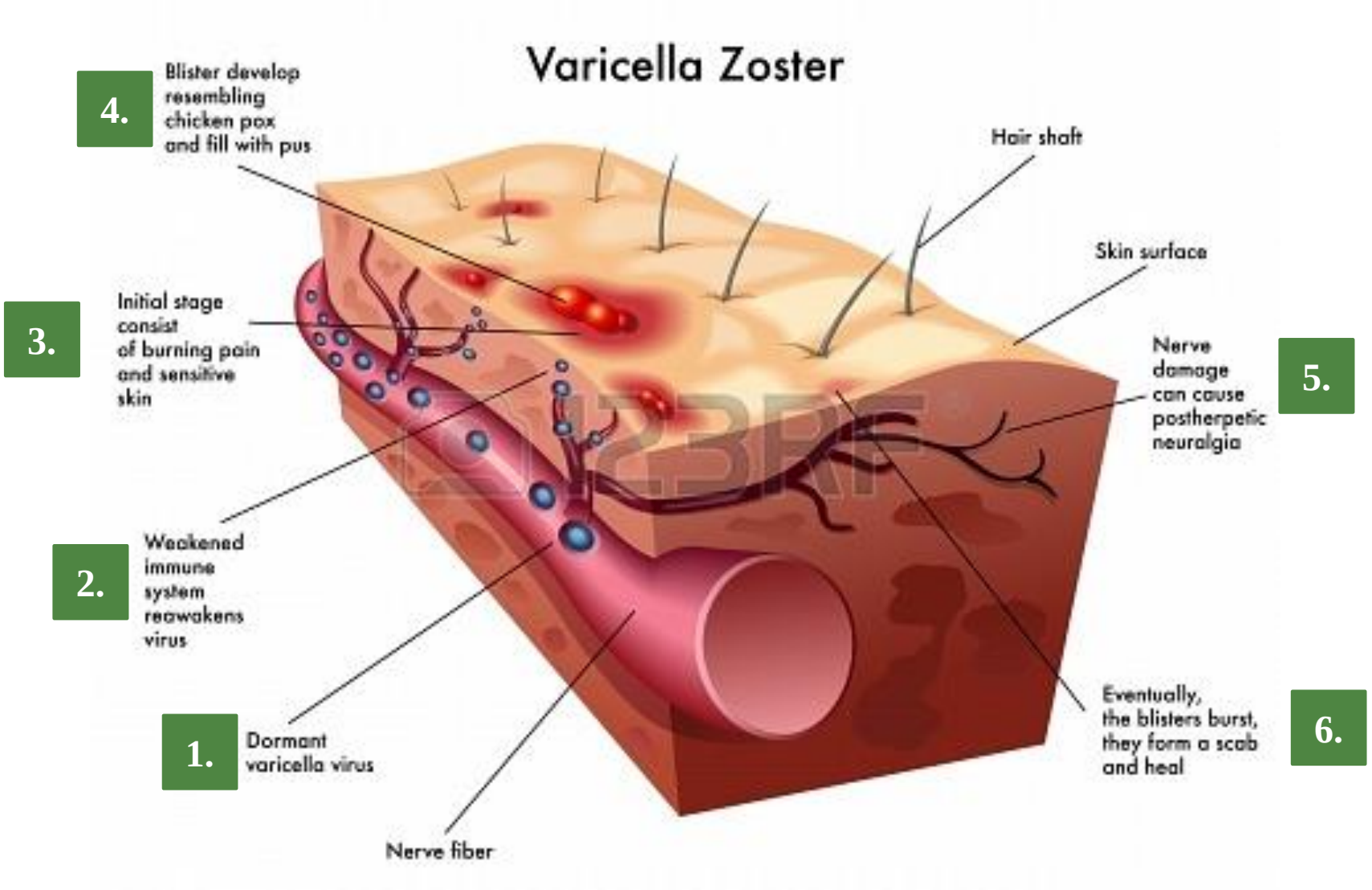
Herpein: to creep & Zoster: girdle

Acute, infectious, extremely painful viral disease



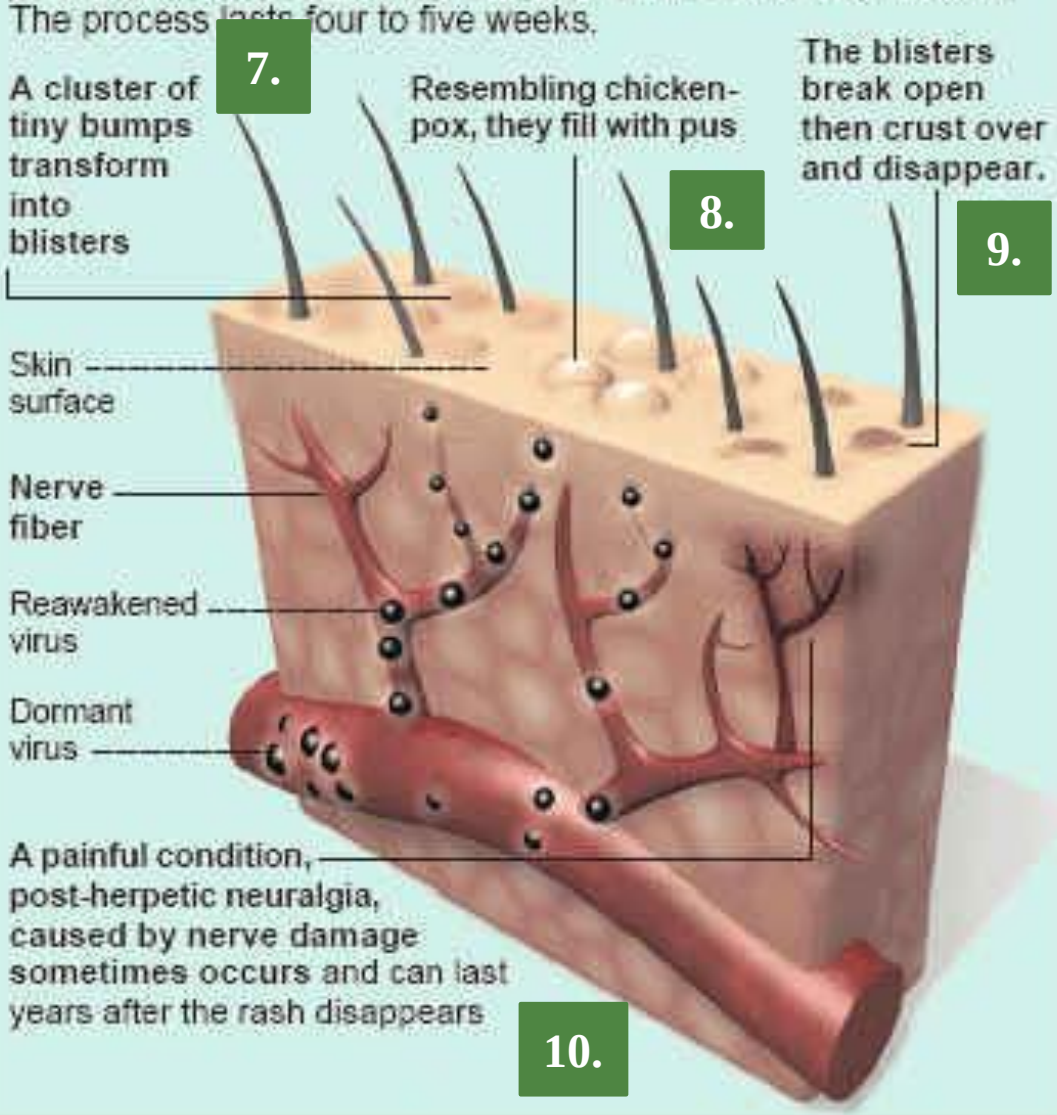


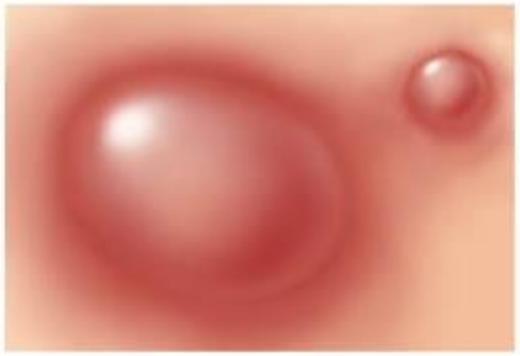
Herpes Zoster: Shingles, Zona



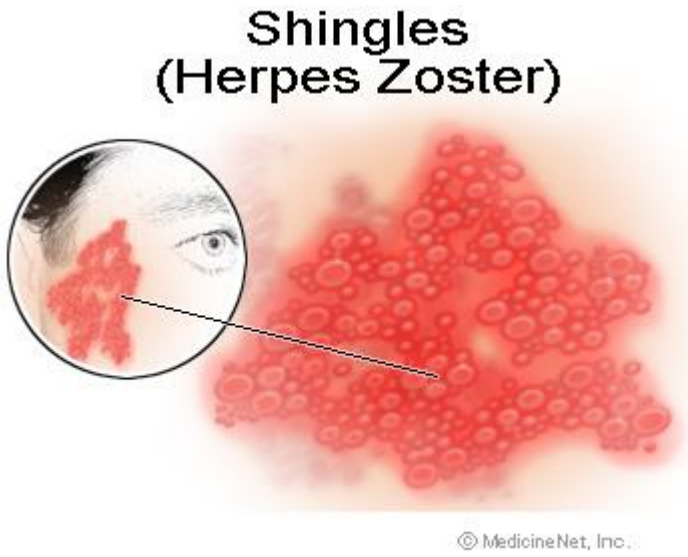
Dormant chickenpox can cause shingles

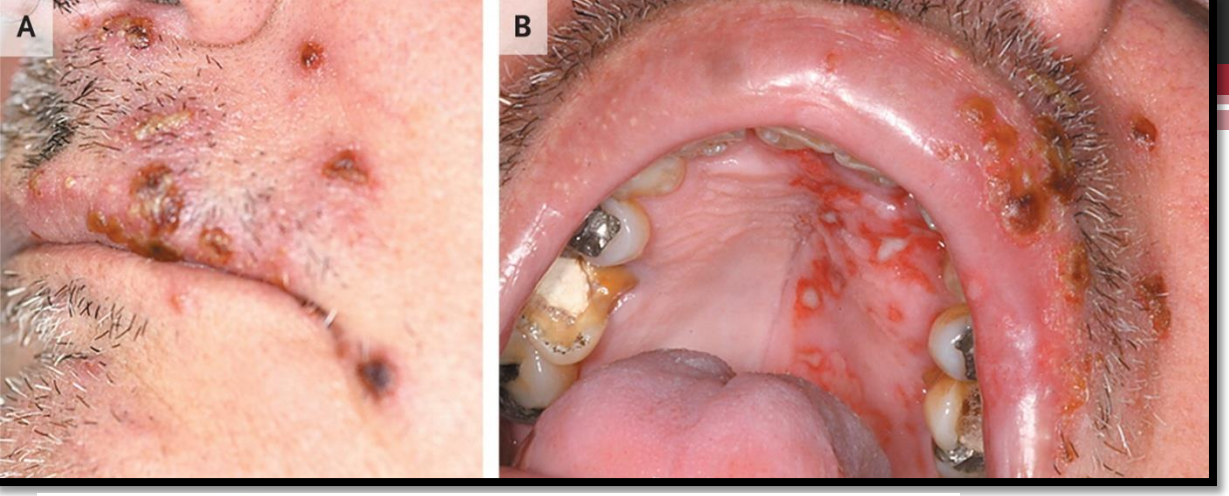
A rash called shingles can attack anyone who has had chickenpox. The virus can lie dormant in the body and resurface years later. Initially causing a burning or tingling sensation on the skin, two to five days after symptoms first appear, a painful rash occurs. The process lasts four to five weeks.



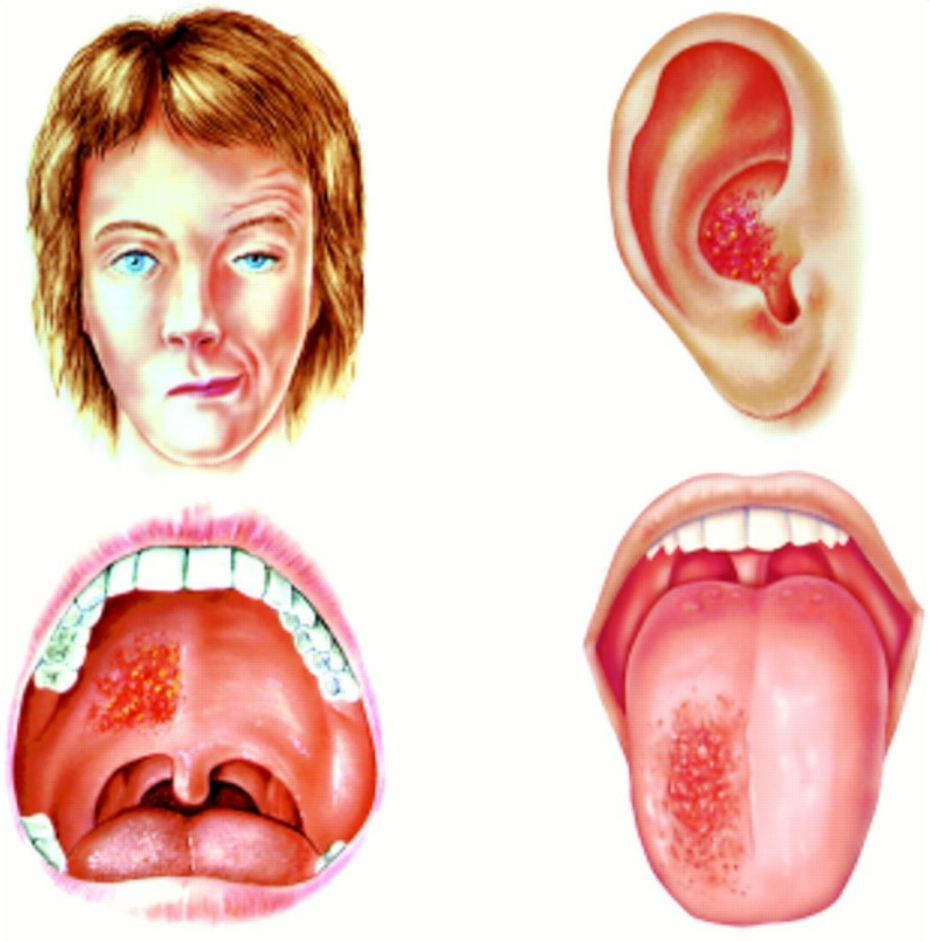


Herpes zoster blisters





Unilateral lesions
Extremely painful vesicles

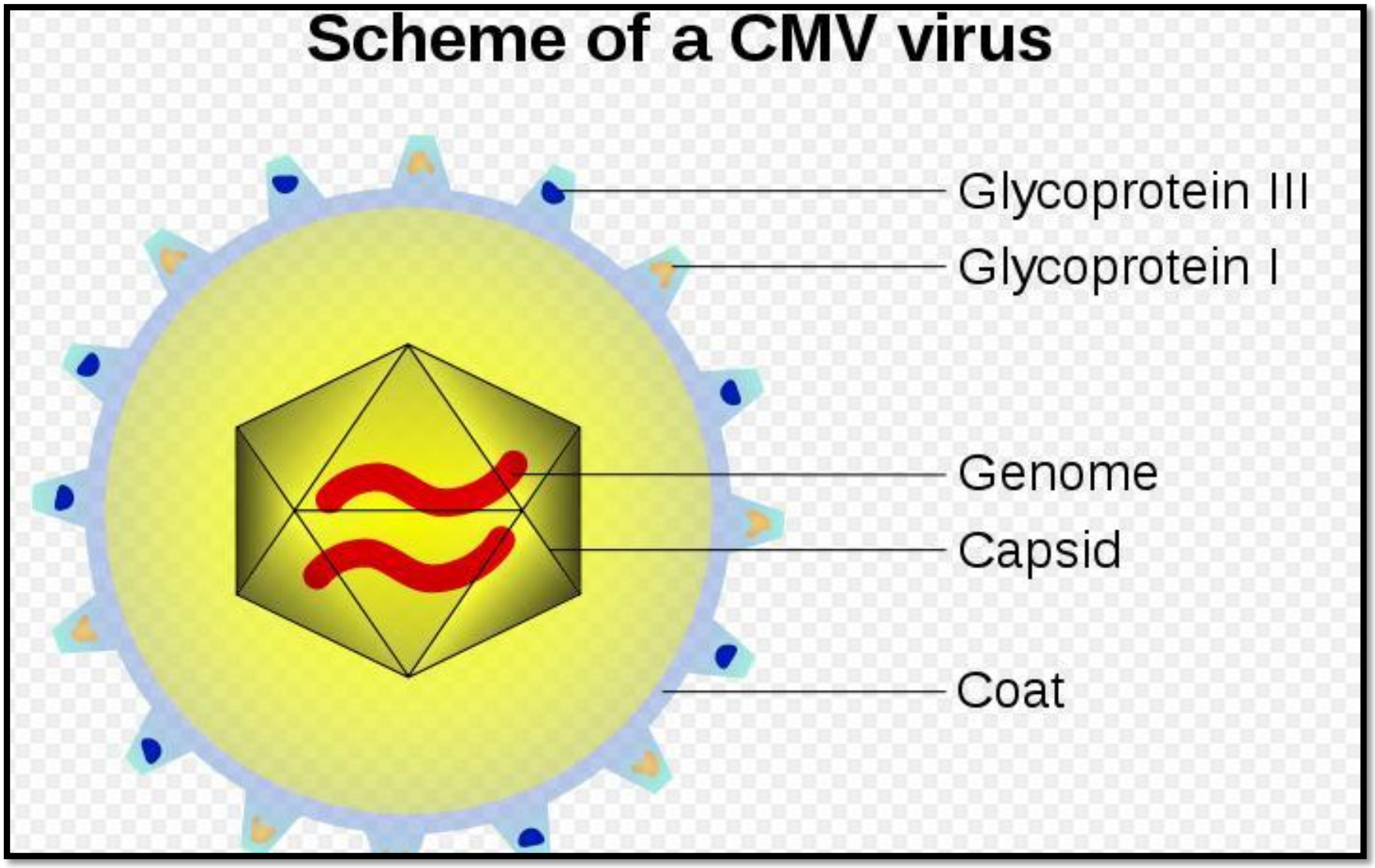


Hunt's Syndrome / James Ramsay Hunt's Syndrome

1. Facial paralysis
2. Pain in ext. auditory meatus & pinna of ear.
3. Vesicular eruptions in oral cavity & oropharynx .
4. Hoarseness, tinnitus & vertigo

Beta Herpes Viruses: Cytomegalovirus

- 1921 called as "Cytomegalia"
- Earlier in 1926, called as "Salivary Gland Virus".
- 1960, Weller named them as "Cytomegalovirus".
- Largest in herpes-virus family, 150-200 nm.


Scheme of a CMV virus
Glycoprotein III
Glycoprotein I
Genome
Capsid
Coat

Mode of Transmission

Mother to child

1. Intra-uterine inf.
2. During birth / milk

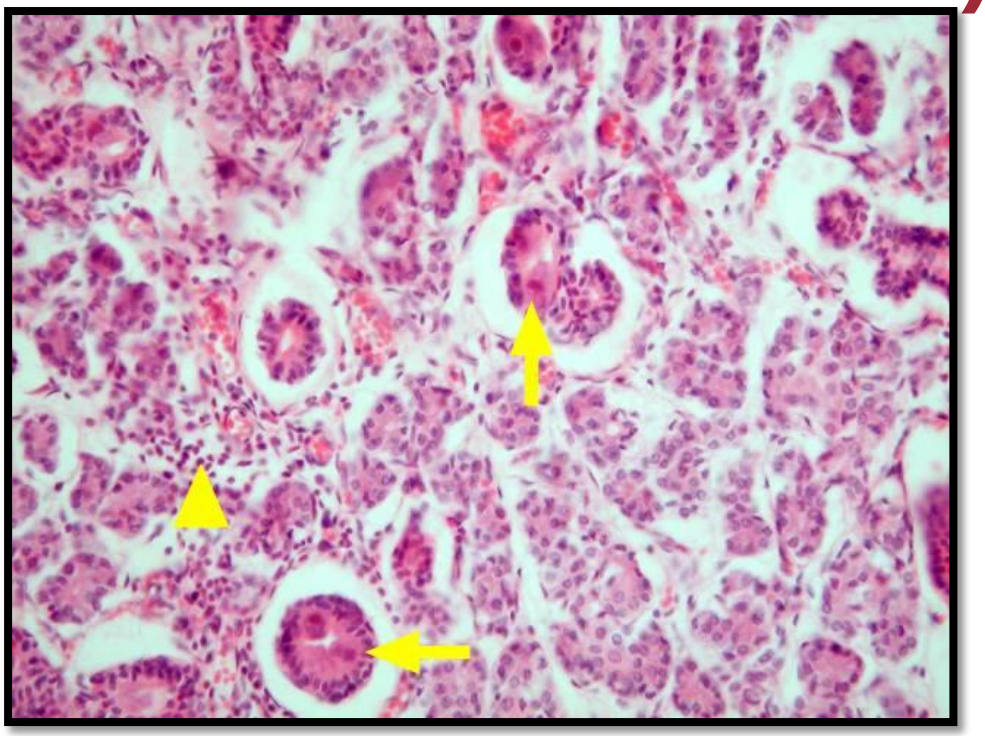
Blood transfusion

CMV infected blood

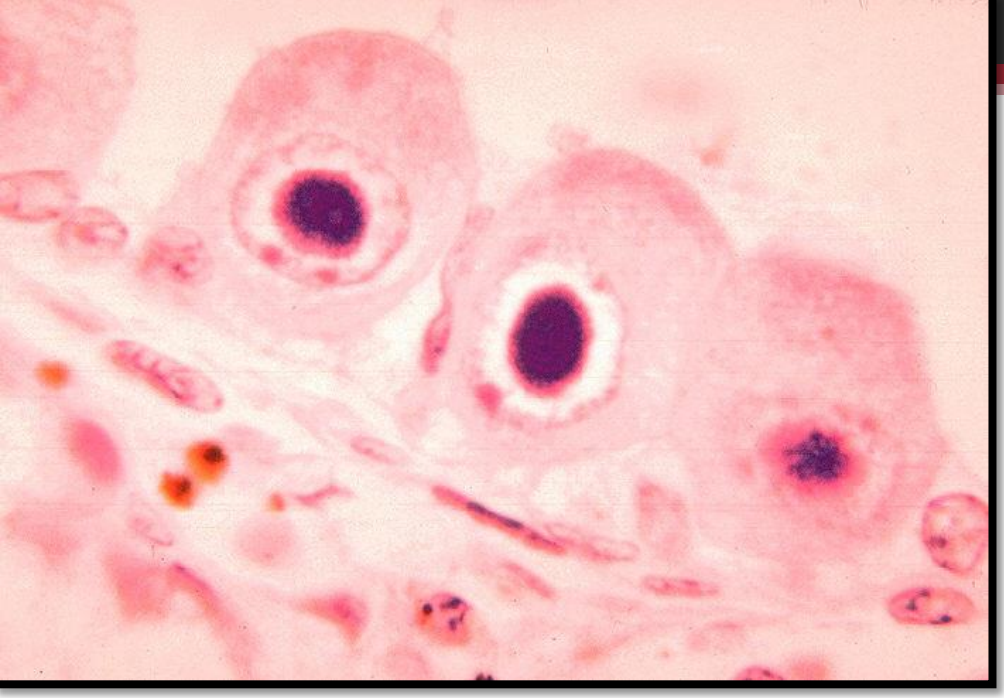
Immuno-compromised patients

1. Transplant patients
2. Cancer therapy
3. HIV / AIDS patients

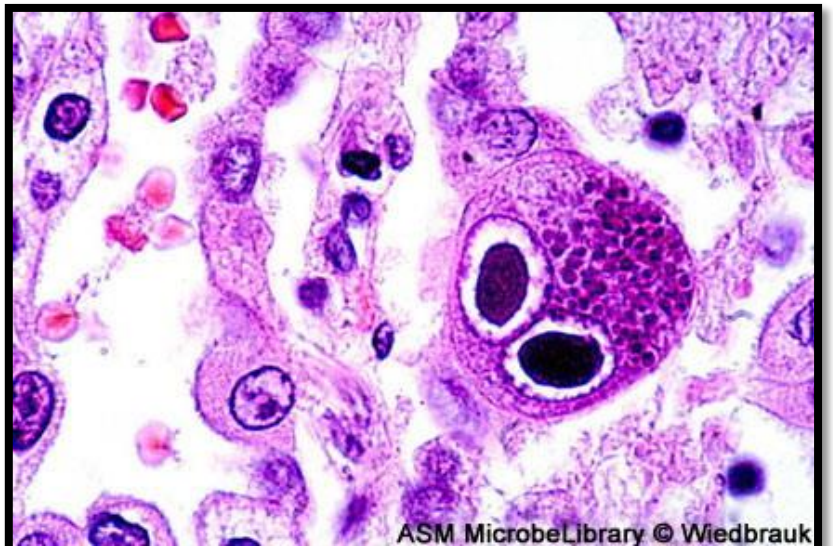
Cytomegalic Inclusion Disease: (Salivary Gland Virus Disease)



- The infected ductal epithelial cells with a large purple intra-nuclear inclusion surrounded by a clear halo.
- Ill-defined basophilic cytoplasmic inclusions are also seen.



Round and discrete intra-nuclear inclusion surrounded by a white thin halo – "Owl's Eye"



Foci of cytomegalic cells are found in fatal cases in the epithelial tissues ...

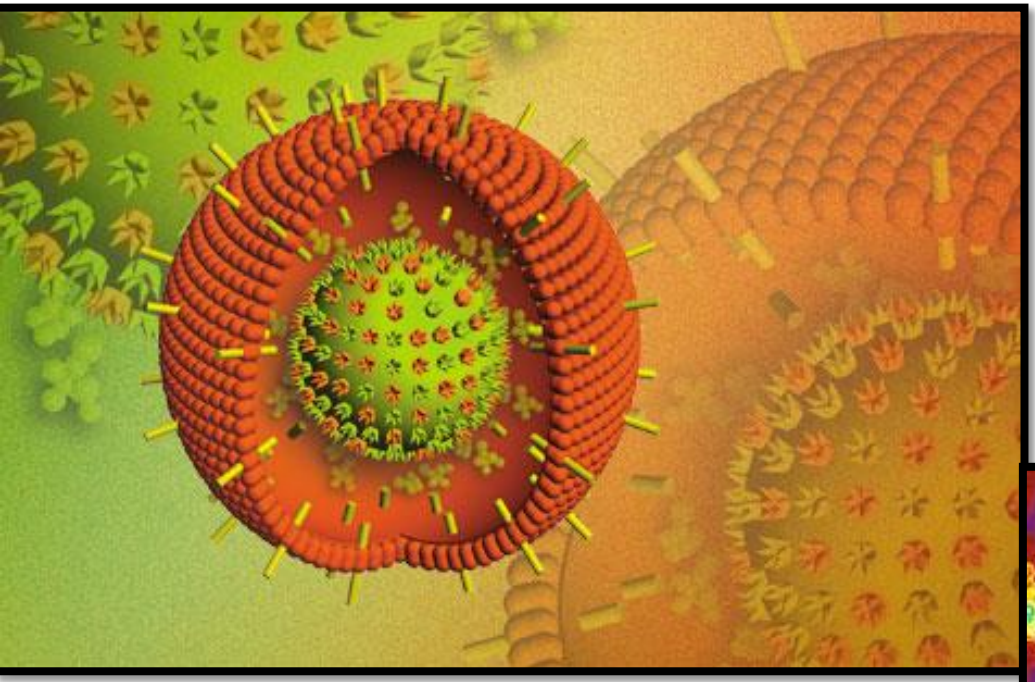
- Other manifestation are:

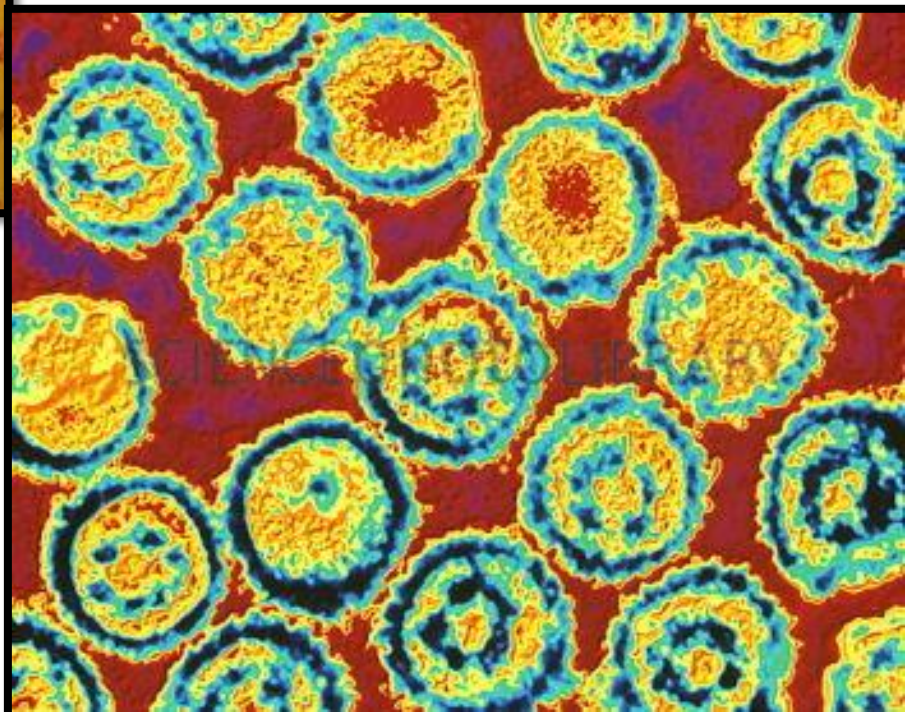
1. Birth defects
2. Mental retardation in infants
3. Cytomegalovirus mononucleosis
4. A/w Kaposi’s sarcoma in AIDS.
5. In AIDS patients damages the immune response further.

Gamma Herpes Viruses: Epstein-Barr Virus

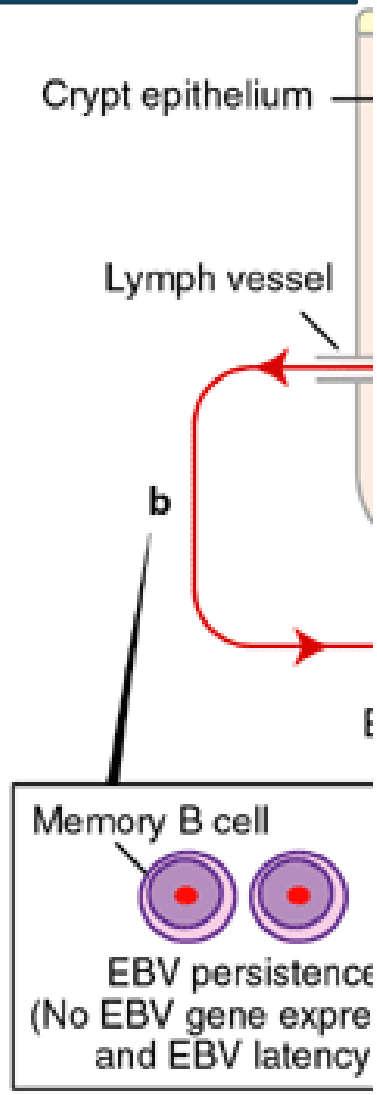
- 1964, Epstein, Barr & Achong found this new virus in cultures lymphoma cells, thus the name.
- Specifically affecting cells of B lymphocyte lineage.
- Source of infection is saliva.

Structure of EBV:



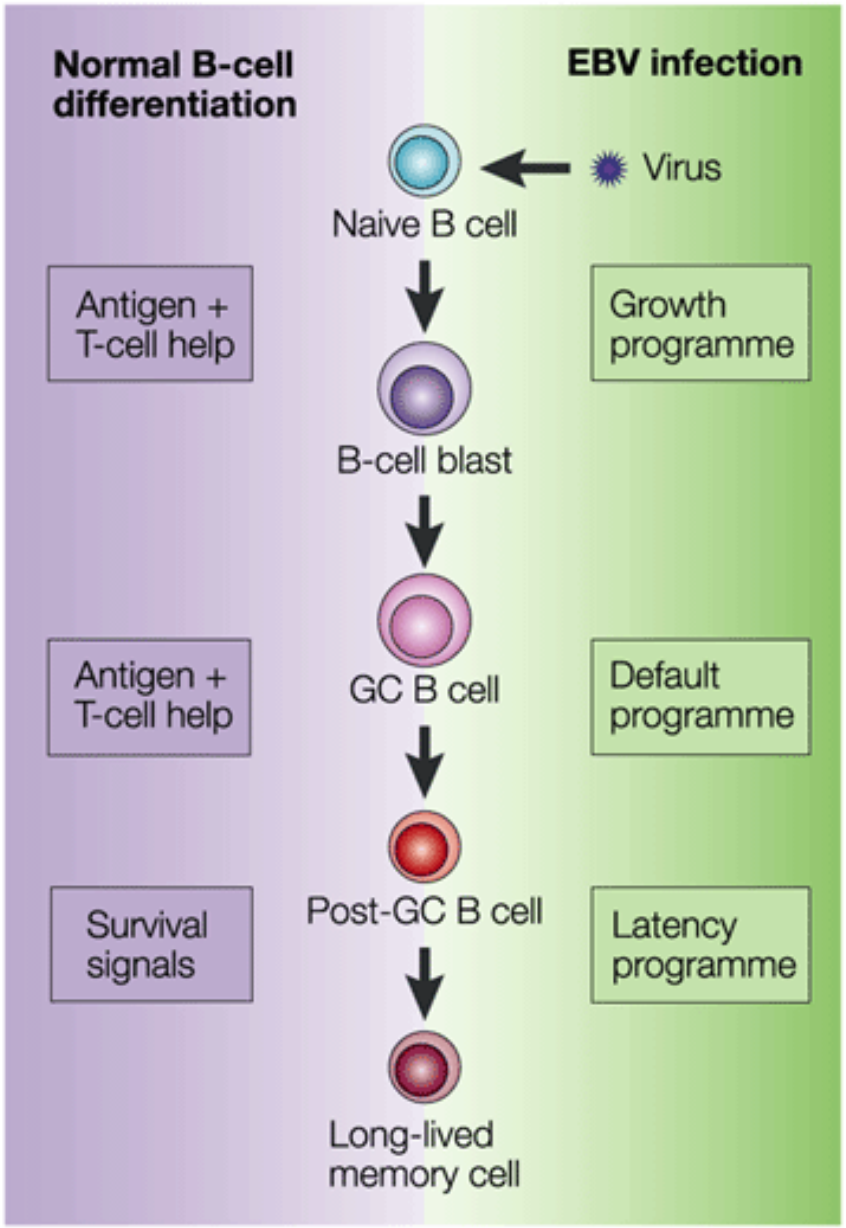


Pathogenesis:

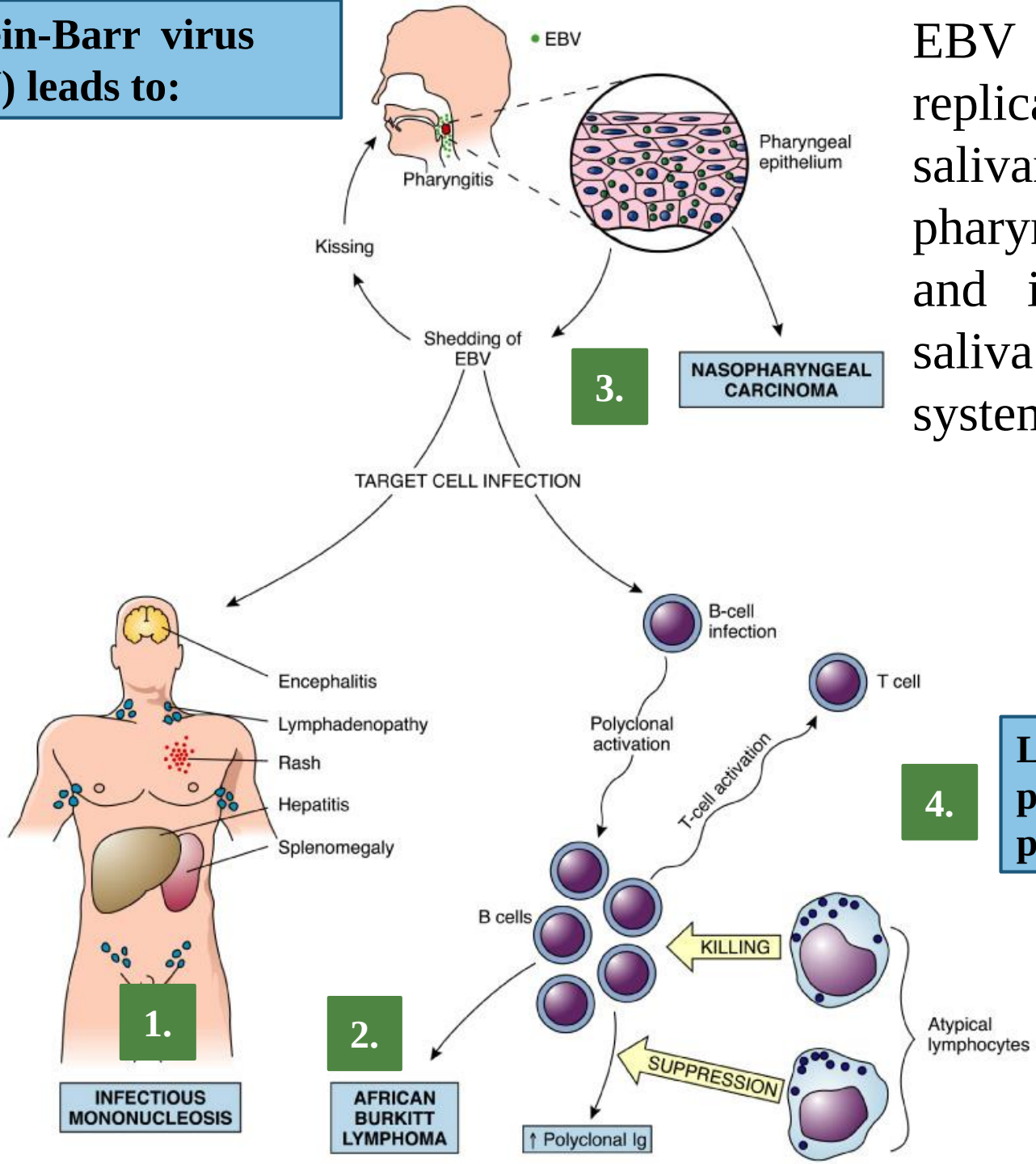


A model for Epst

Expert Reviews in Mol



Epstein-Barr virus (EBV) leads to:



EBV invades & replicates within the salivary glands or pharyngeal epithelium, and is shed into the saliva and respiratory system.

Human Herpes Virus Types 6, 7 & 8

HHV-6:

- Isolated in 1986, from peripheral blood of patients with lympho-proliferative disease, called HHV-6.
- Spreads through saliva.
- 2 variants: A & B

- In Children: Exanthem Subitum
- In adults: Infectious Mononucleosis
  Focal Encephalitis
  In immunodeficient: pneumonia
  disseminated disease

HHV-8:

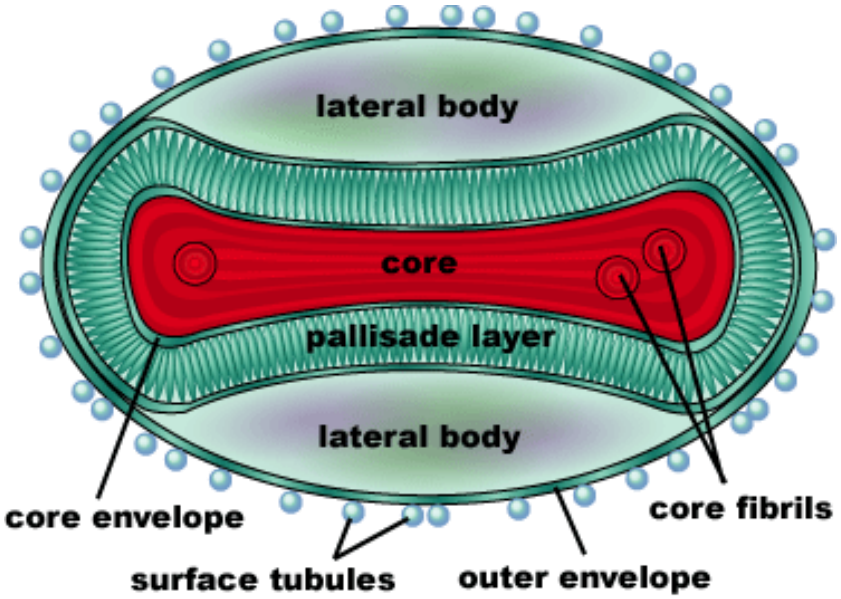
- Isolated in 1990, from peripheral CD4 cells of a healthy person.
- Isolated in 1994, from DNA sequences from tissues of Kaposi's sarcoma from AIDS patients.
- Transmitted through saliva.
- Also isolated in Kaposi's sarcoma in persons not infected with HIV, so also known as Kaposi's sarcoma-associated herpes virus (KSHV).
- It shares with HIV-1 the same CD4 receptor on the T cells, thus leads to further depletion of CD4 T cells in HIV infected patients.

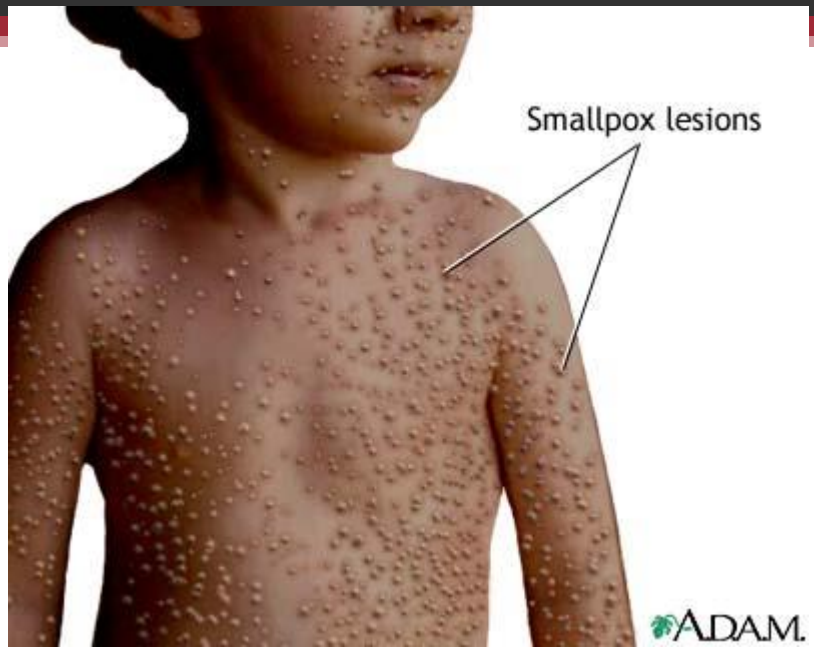
DNA Viruses: Pox Viruses

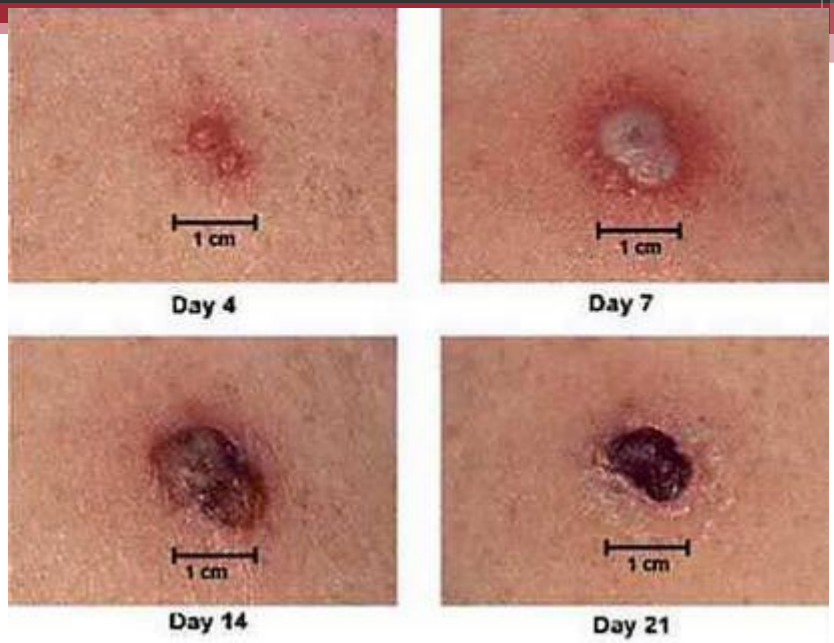
1. Smallpox
2. Molluscum Contagiosum

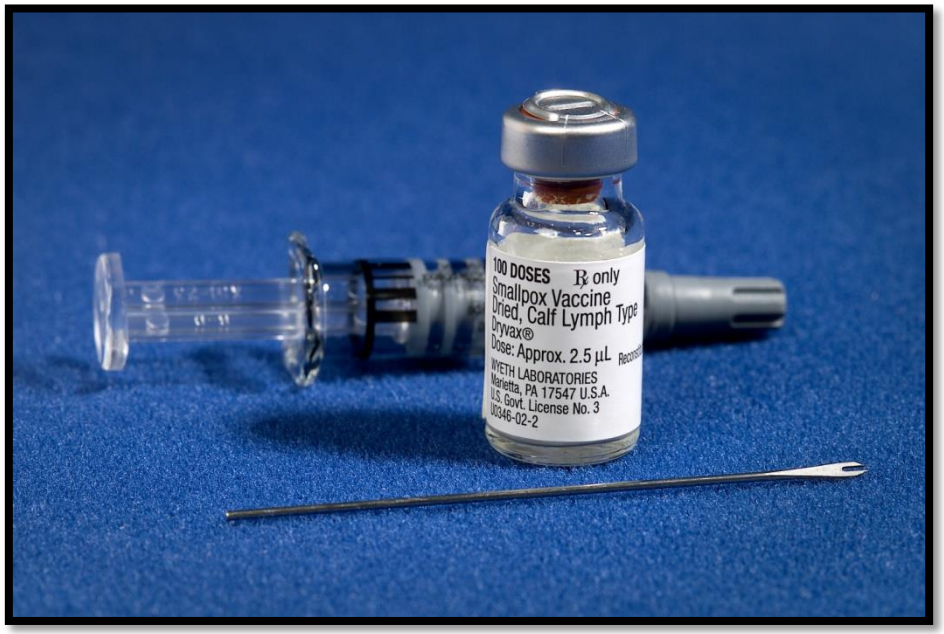
Smallpox (Variola):

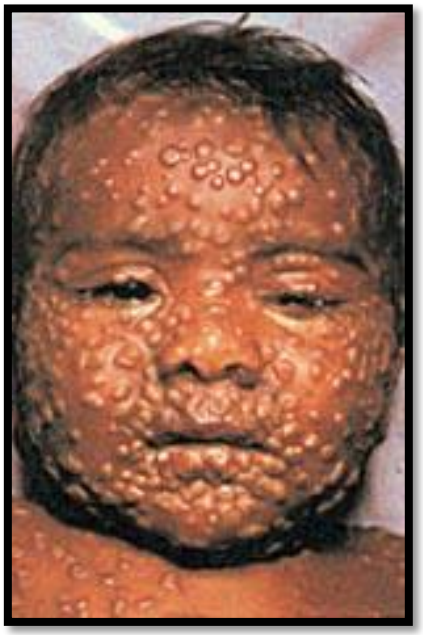
- Completely eradicated.
- First vaccination introduced by Jenner in 1796.
- Last case in world reported in Somalia in 1977 & in Africa in 1978 in lab in London.




Smallpox lesions
A.D.A.M.


1 cm
Day 4
1 cm
Day 7
1 cm
Day 14
1 cm
Day 21


100 DOSES
℞ only
Smallpox Vaccine
Dried, Calf Lymph Type
Dryvax®
Dose: Approx. 2.5 µL
WYETH LABORATORIES
Marietta, PA 17547 U.S.A.
U.S. Govt. License No. 3
0346-02-2

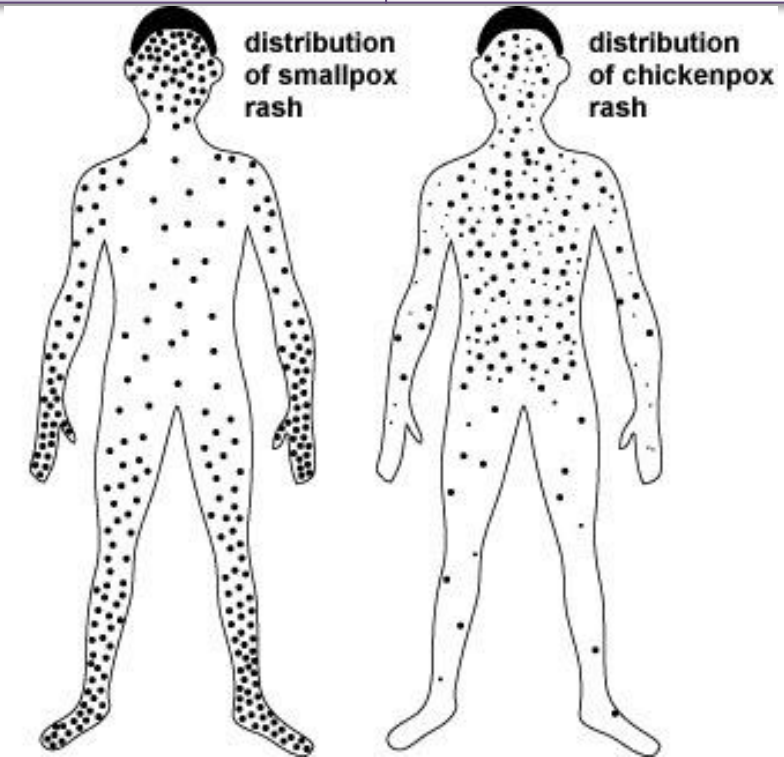


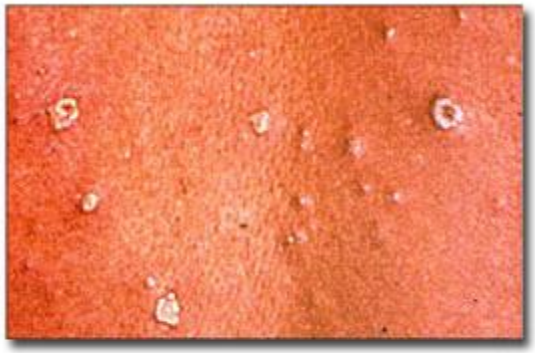
Differences between Chickenpox and Smallpox rash

	Chickenpox	Smallpox
How initial symptoms differ	0 to 2 days of mild illness pass before the rash develops.	2 to 3 days of severe illness pass before the rash develops.
	Lesions first appear on the face or trunk.	Lesions first appear in the throat or mouth, then on the face, or on the upper arms.
How the rash lesions differ	Lesions develop in successive fashion. While some are new, others are crusting over (in "crops").	Lesions develop at the same time, and they look alike on any one section of the body, such as the abdomen, arms, or face.
	Lesions change rapidly, crusting over within 24 hours.	Lesions change slowly, scabbing over after 9 to 15 days.
	Lesions sit on the skin surface like a "dewdrop on a rose petal."	Lesions become firm, dome-shaped, and deep in the skin

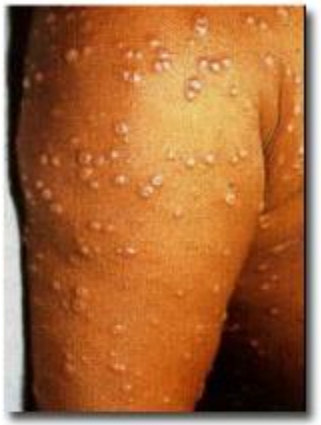
Chickenpox Smallpox

How the rash lesions differ	Rash rarely develops on palms and soles.	Rash commonly develops on palms of the hands and soles of the feet.
	Lesions are most concentrated on the torso, with fewest on the hands and feet. Lesions can affect the face and scalp, but rarely affect the entire body equally	Lesions are most concentrated on the face, hands, and feet.





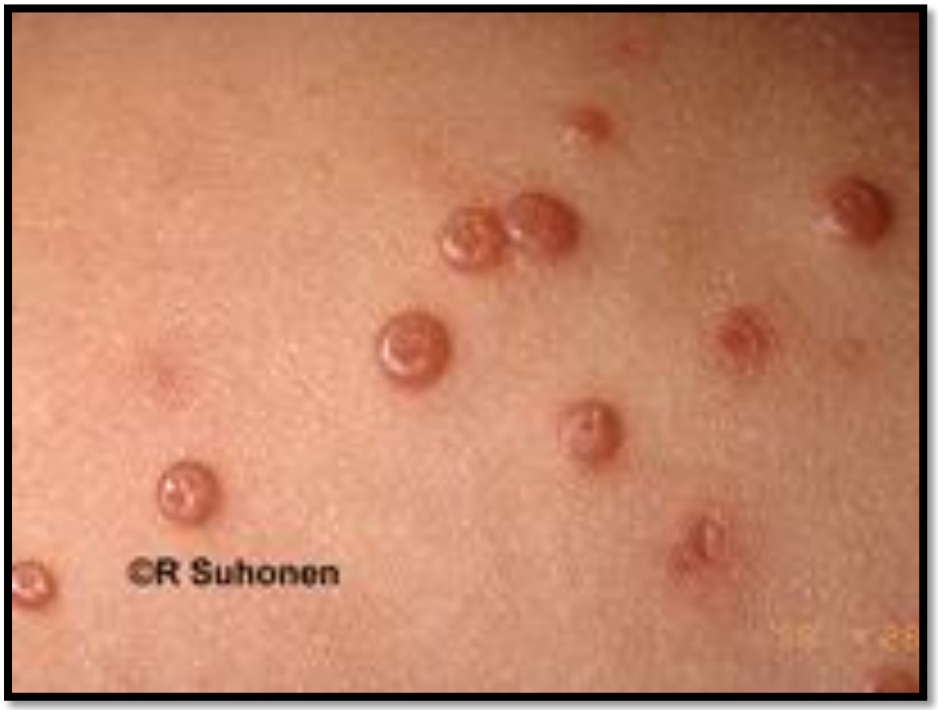
Chickenpox rash

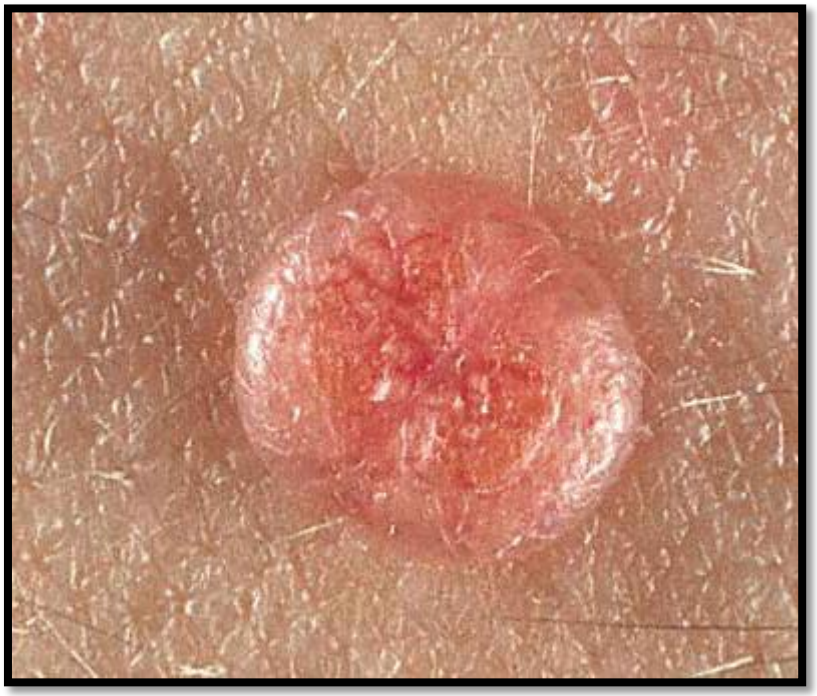


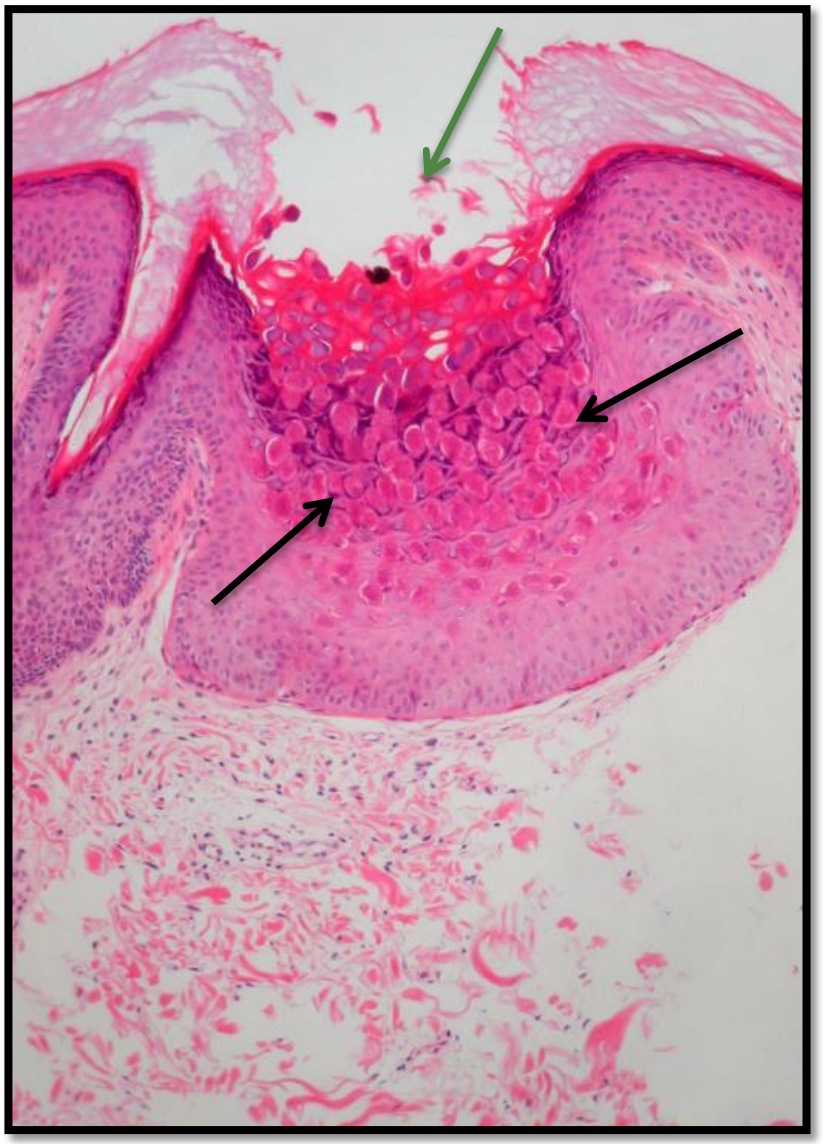
Smallpox rash

Molluscum Contagiosum:

Hemispheric in shape, 5 mm in diameter, multiple, discrete elevated nodules, with central umbilication (keratinized) & slightly red in colour.







- Large eosinophillic intra-cytoplasmic inclusion bodies called "Henderson-Paterson Inclusions".

- Accumulate in the crater formed by the distinctive umbilication of the dome-shaped lesion.

RNA Viruses: Picornavirus

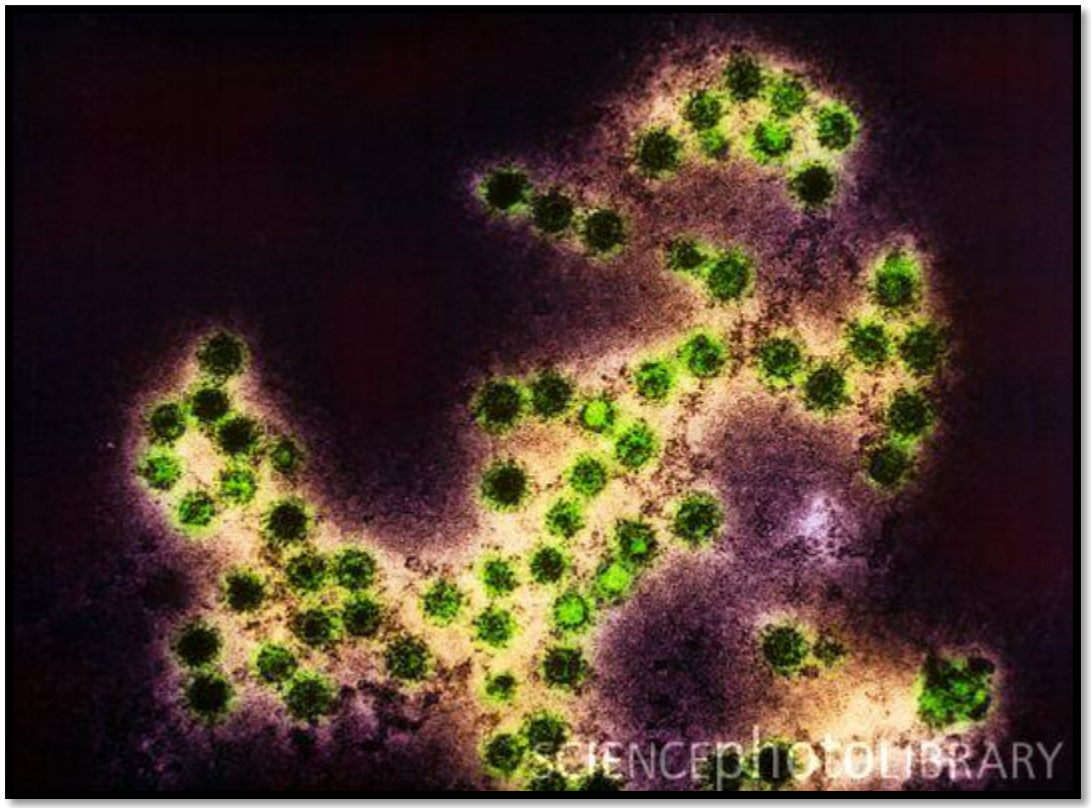
1. Herpangina
2. Acute Lymphonodular pharyngitis
3. Hand, foot & mouth Disease
4. Foot & mouth disease

Herpangina

Aphthous Pharyngitis
Vesicular Pharyngitis

Zahorsky in 1920

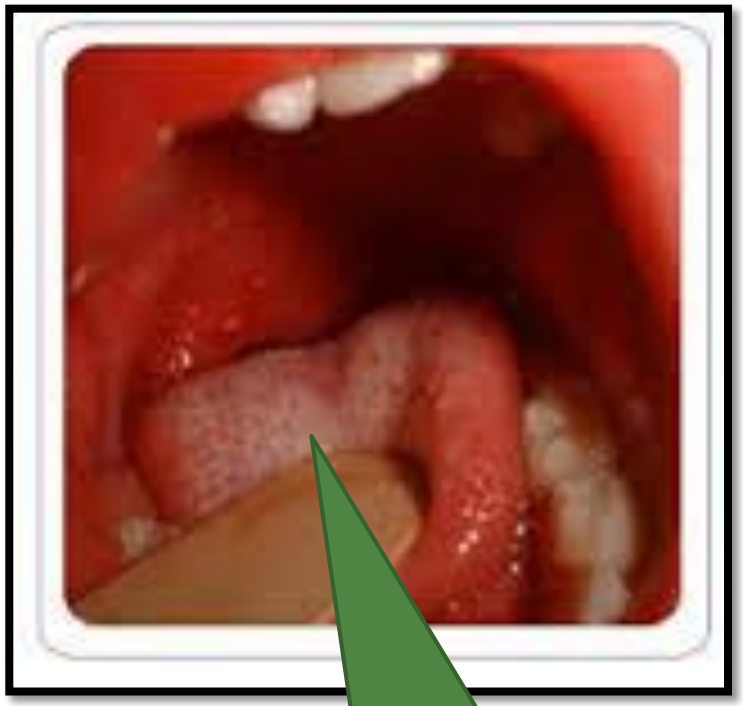
Coxsackie group A virus



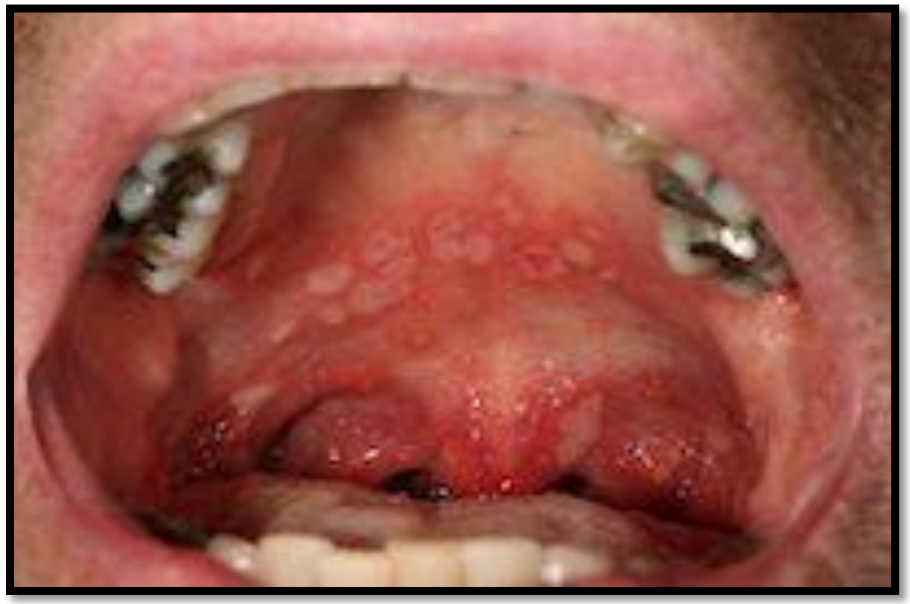
Incubation period: 2-10 days

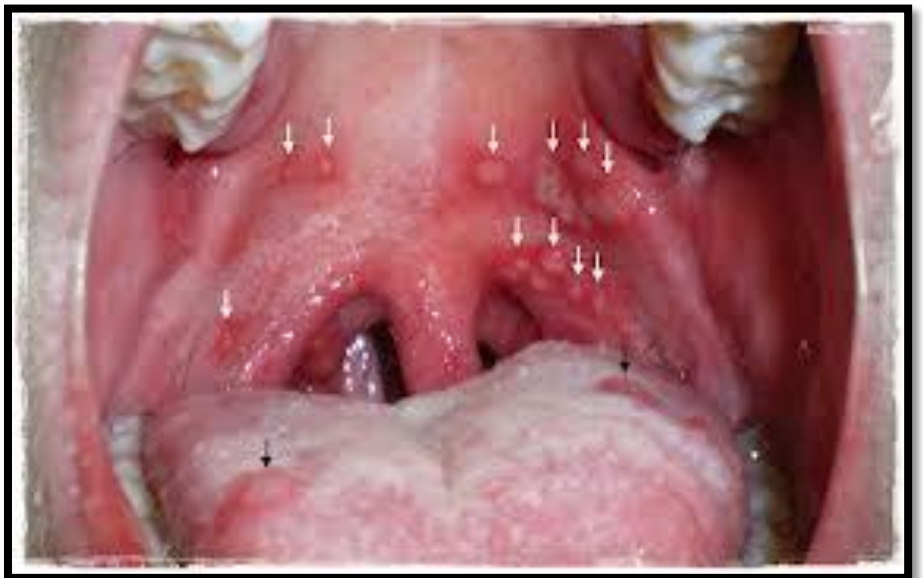
A summer disease, common in children.

Clinical features:



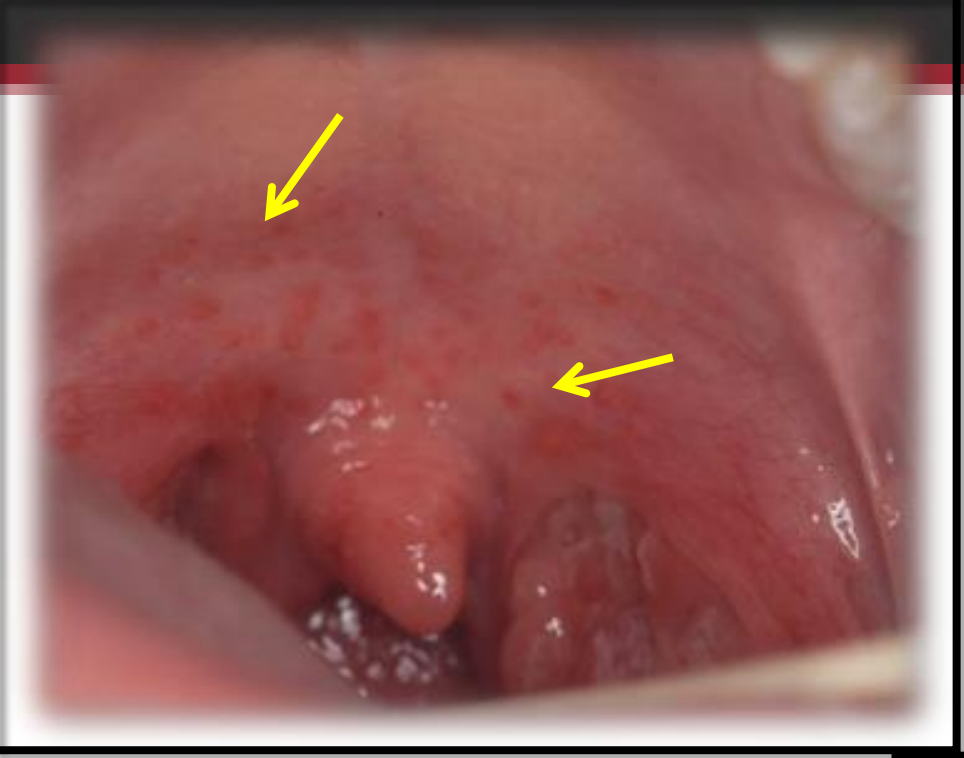
Sore throat, low-grade fever, head-ache, rhinorrhea





Acute Lymphonodular Pharyngitis

- **Steigman & co-workers in 1962**
- **Caused by Coxsackie A10 virus**
- **Marked similarities to Herpangina.**

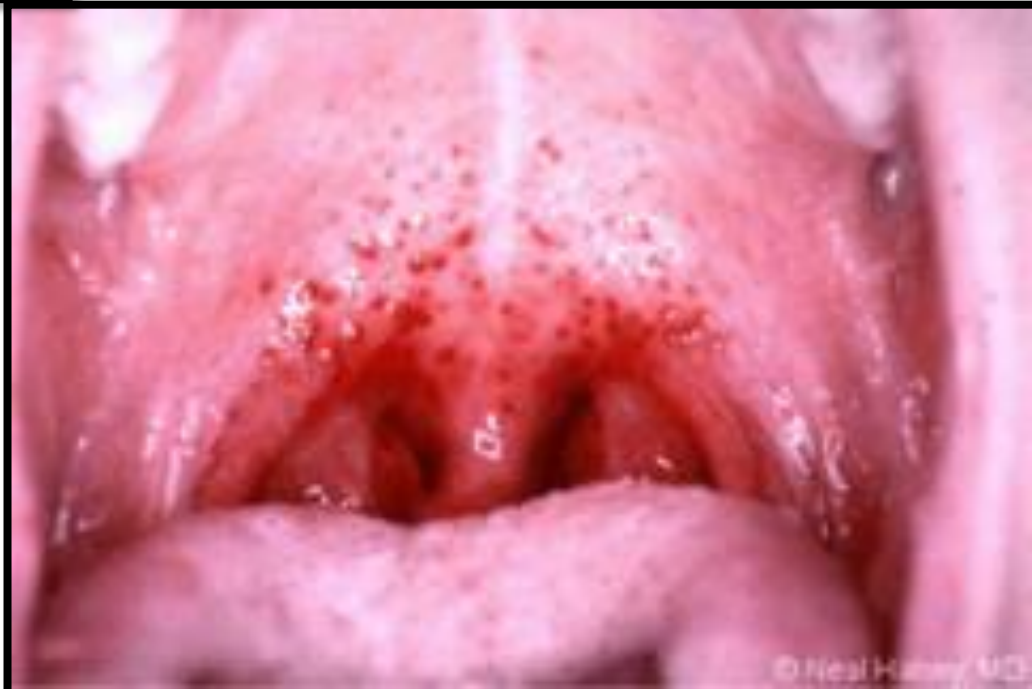


High-grade fever & sore throat

Raised, discrete, whitish or yellowish to dark pink solid papules surrounded by narrow zone of erythema

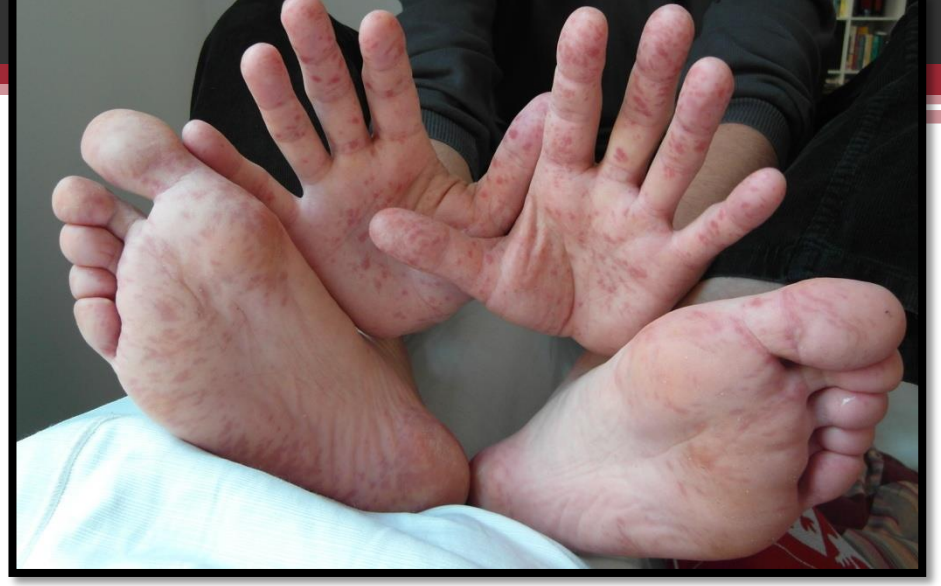
Not vesicular & do not ulcerate. Commonly involving uvula

Papules consists of hyper-plastic lymphoid aggregates & intra-cytoplasmic viral inclusion



Hand, Foot & Mouth Disease

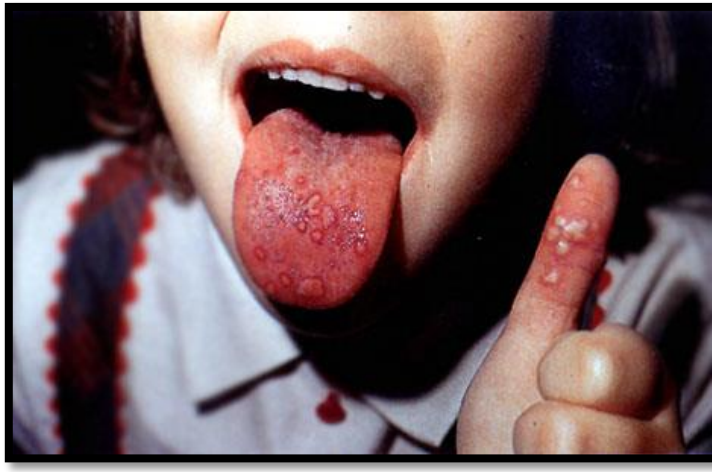
- **Robinson & co-workers in 1958**
- **Caused by Coxsackie A16 virus**



Maculo-papular, exanthematous & vesicular lesions of the skin

Intra-cytoplasmic viral inclusions

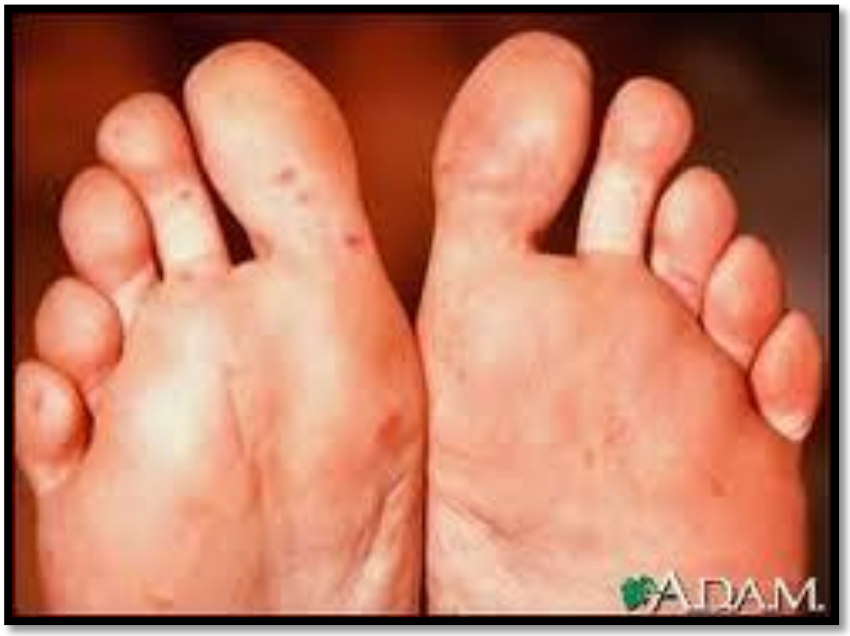
Oral lesions are numerous, small, multiple vesicular & ulcerative



Foot & Mouth Disease

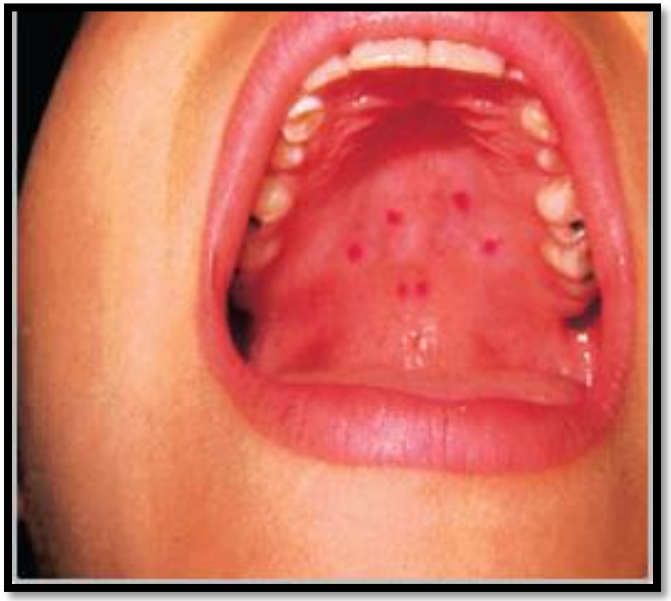
- **Apthous fever, Hoof & mouth disease, Epizootic stomatitis**

- **Rarely affects humans**



Vesicular lesions of the skin

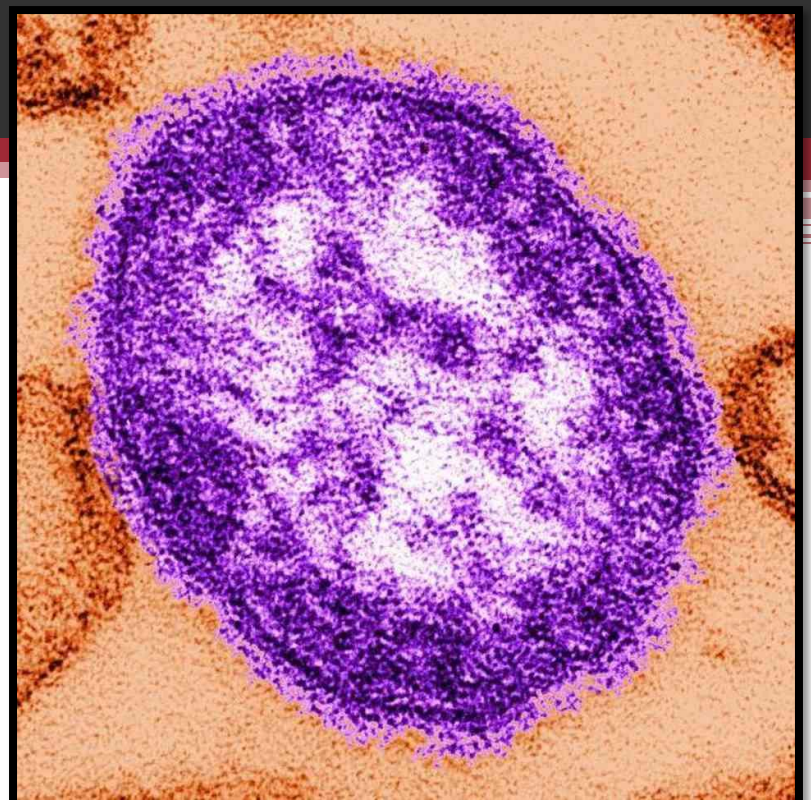
Small vesicles rupture rapidly & heal in 2 weeks



RNA Viruses: Paramyxovirus

1. Measles
2. Mumps

Measles
(Rubeola, Red spots, Morbilli)



Examp

1. Attach

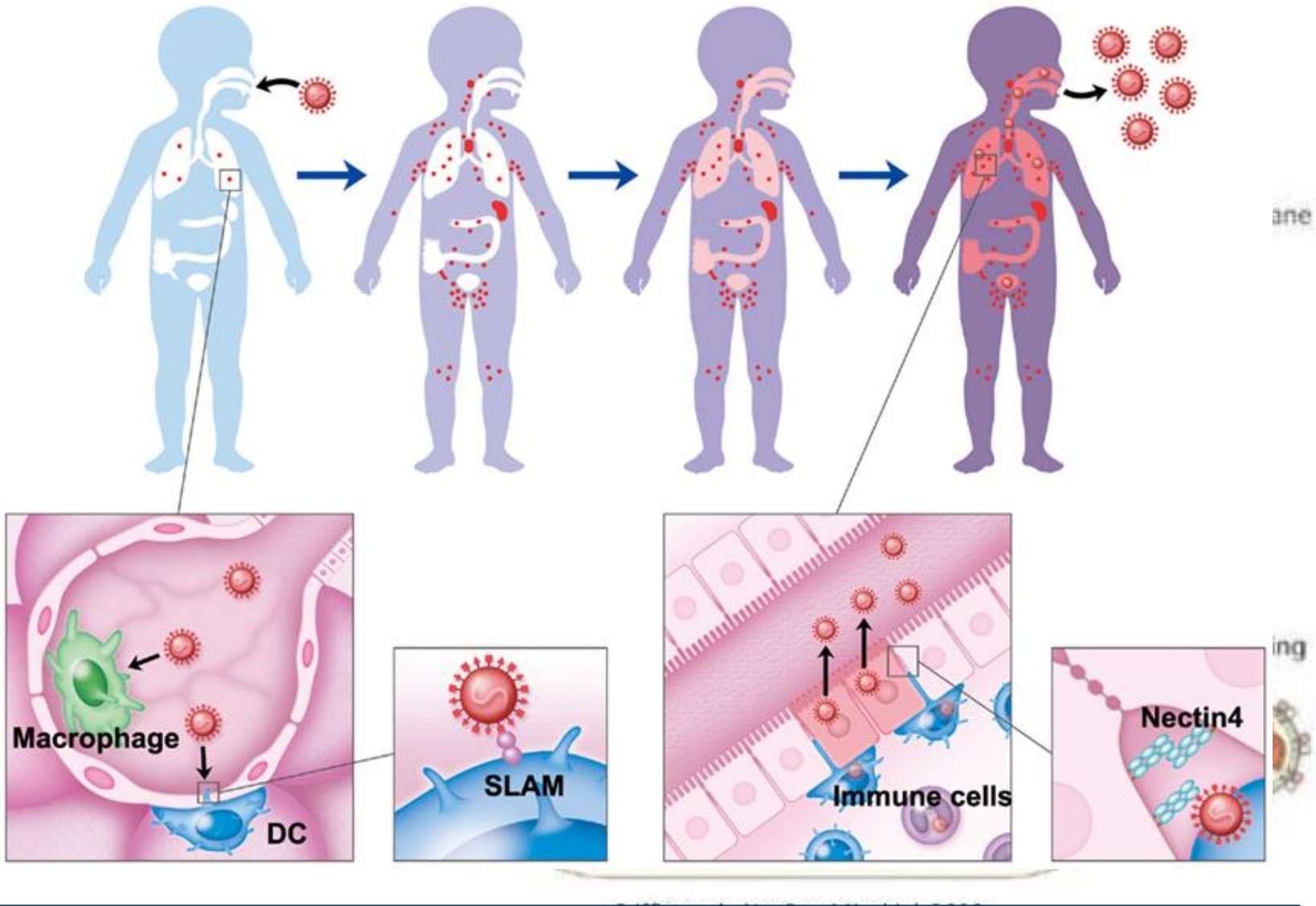
2. Fusion

3. Transc
RNA into

4. Transl
the cytop
ER (viral

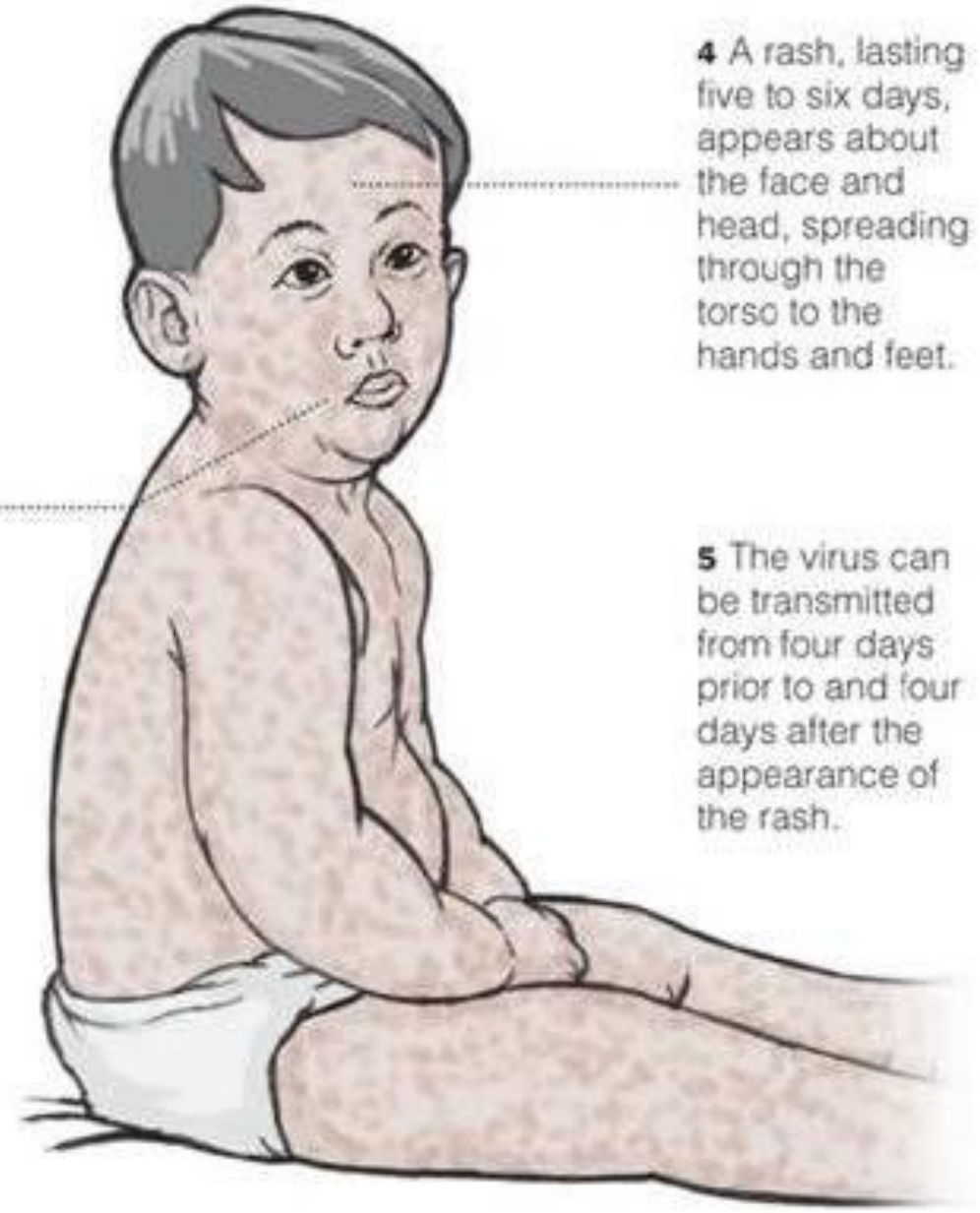
5. Assen
virions at

6. Relas



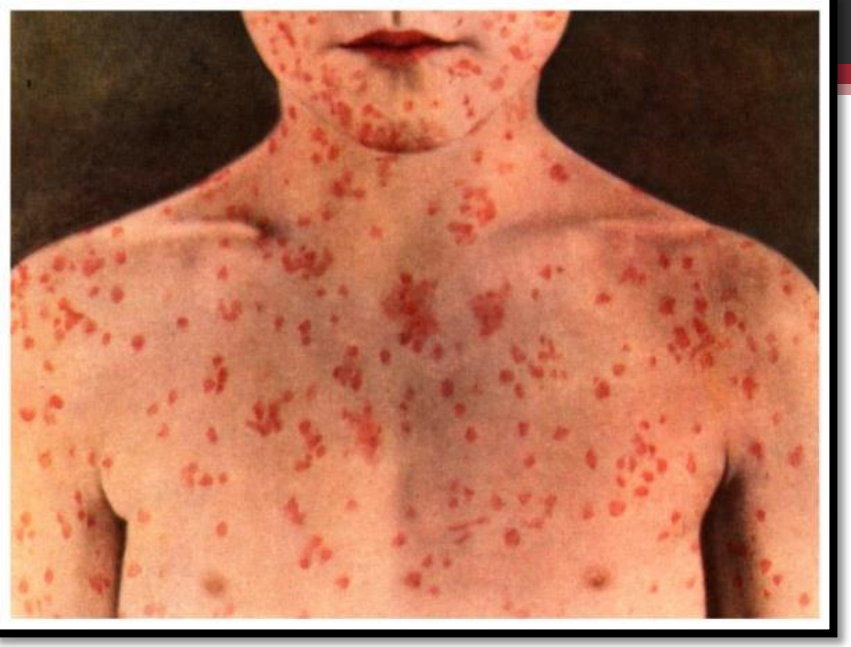
Respiratory system ⟶ Blood ⟶ invasion of T -lymphocytes ⟶ suppression of cellular

Characteristics of Measles



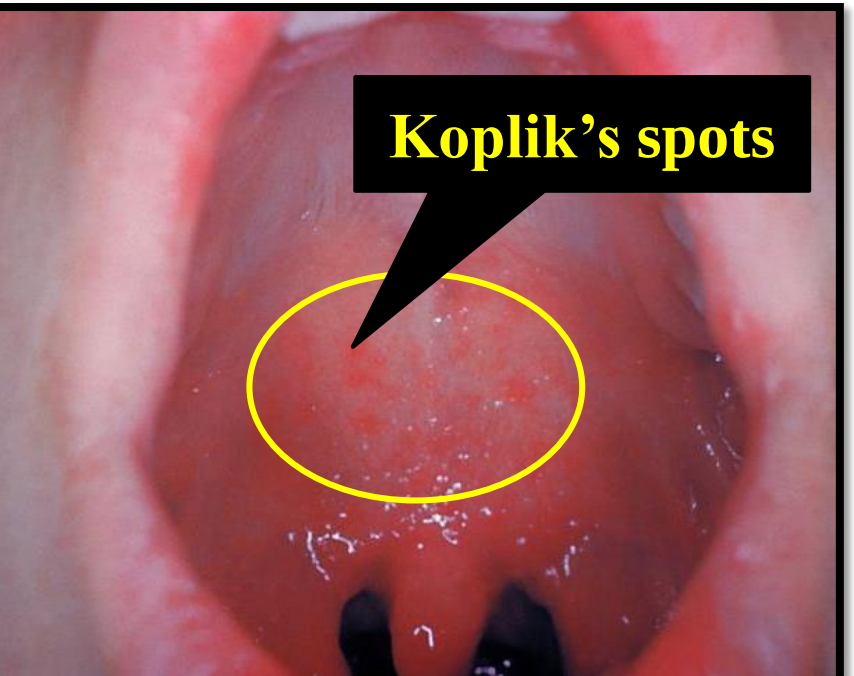
3 stages:

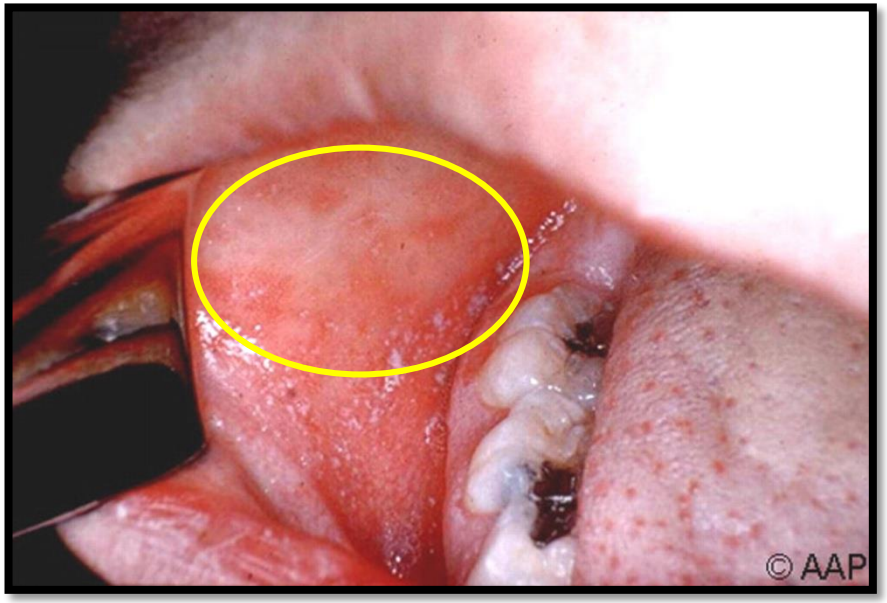
1. Pre-eruptive / prodormal
2. Eruptive
3. Post-eruptive

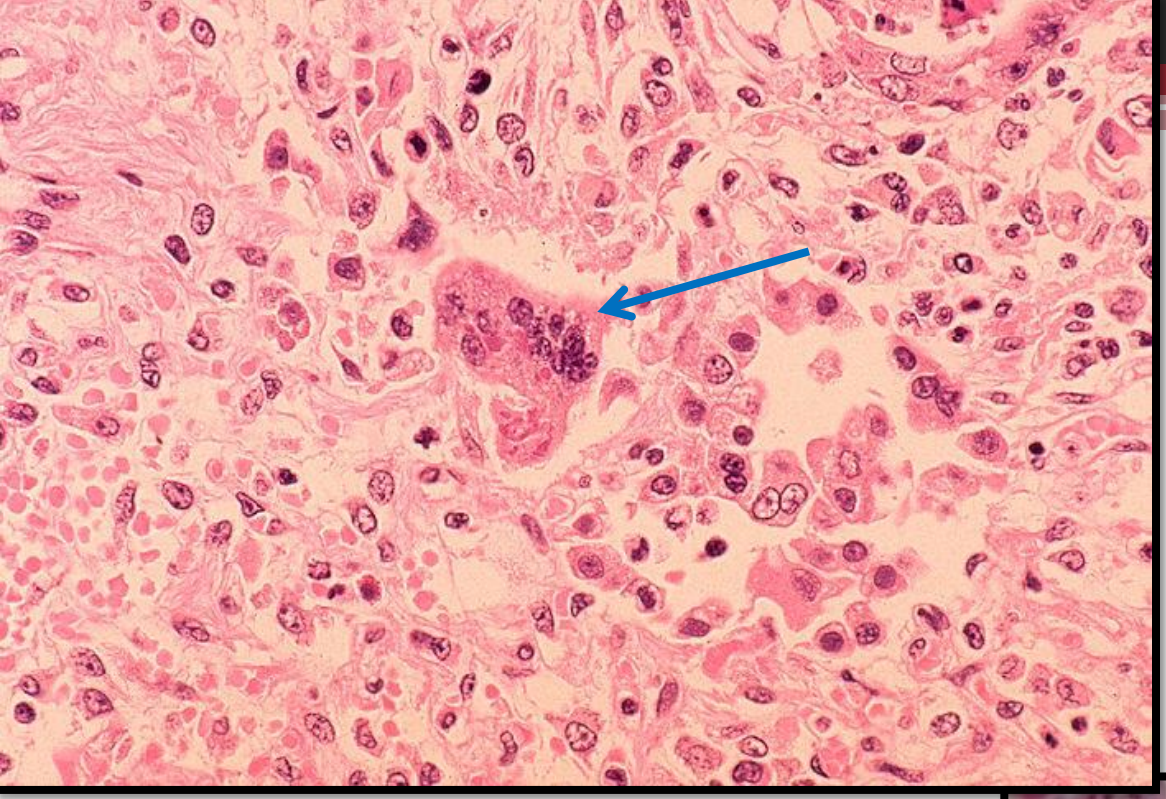


Red macules which blanch on pressure

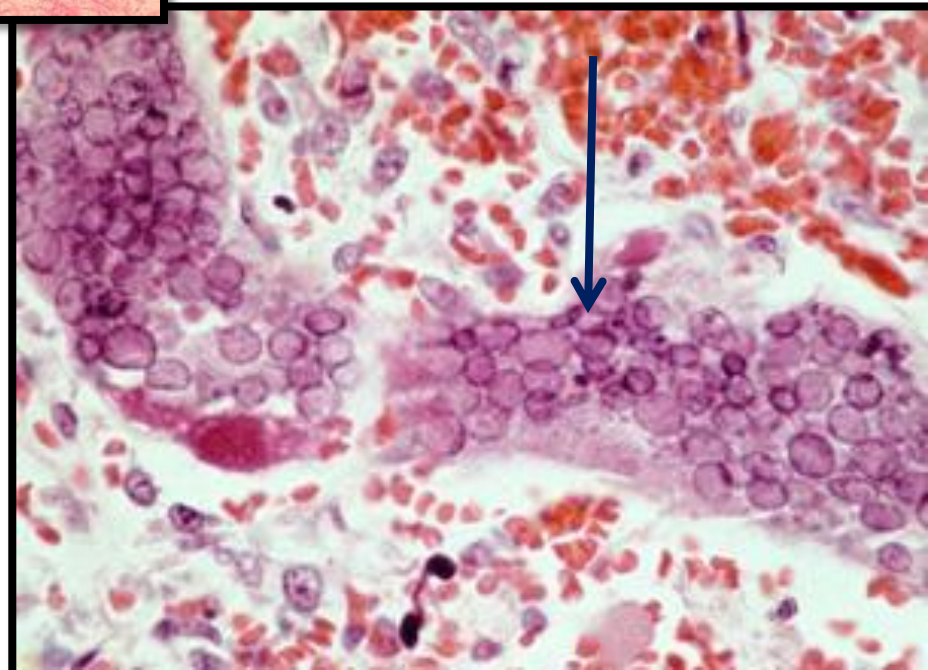
Oral lesions appear before rash. Disappear after the appearance of rash.

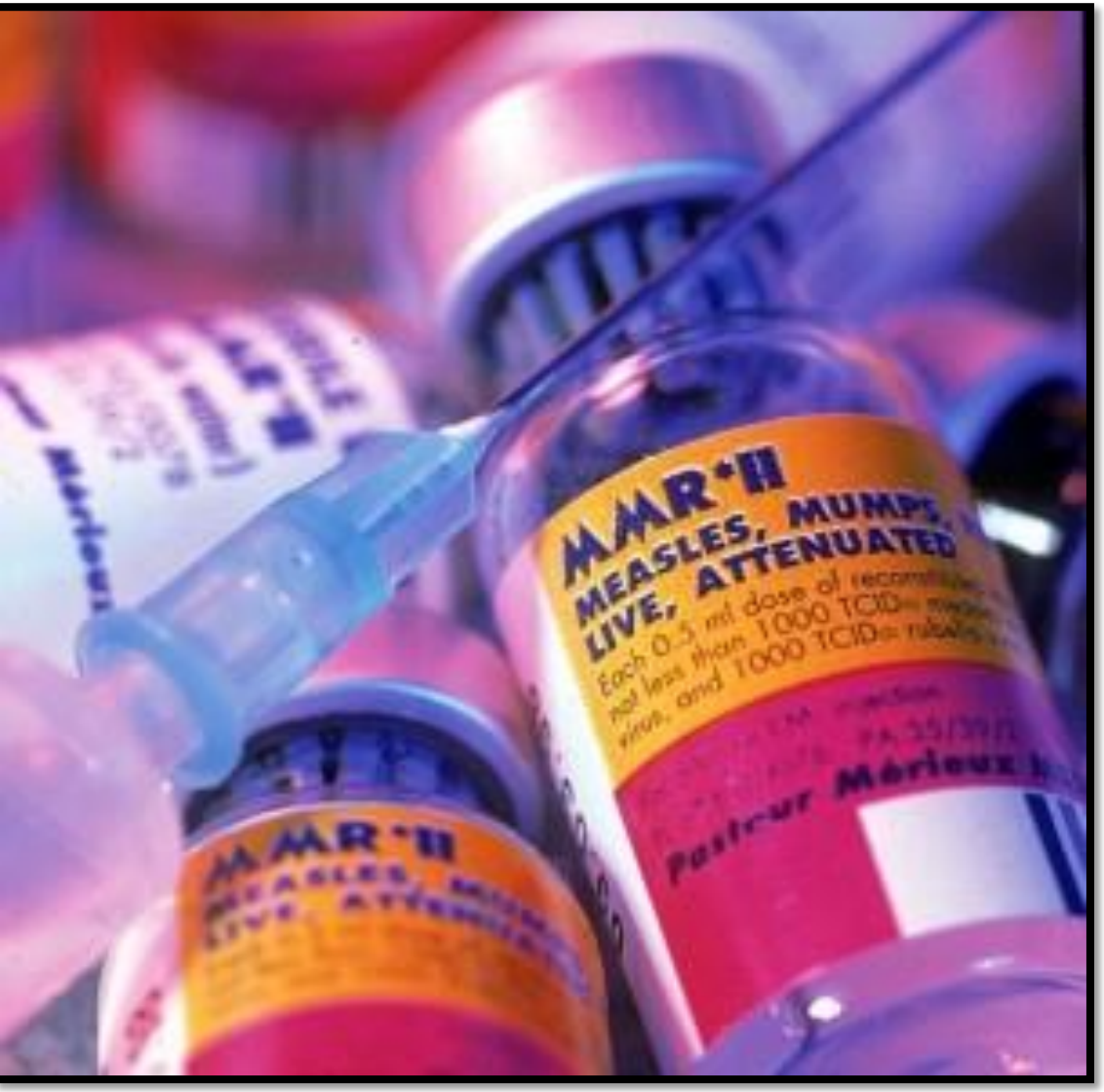






Muti-nucleated giant cells called Warthin-Finkeldey Giant Cells



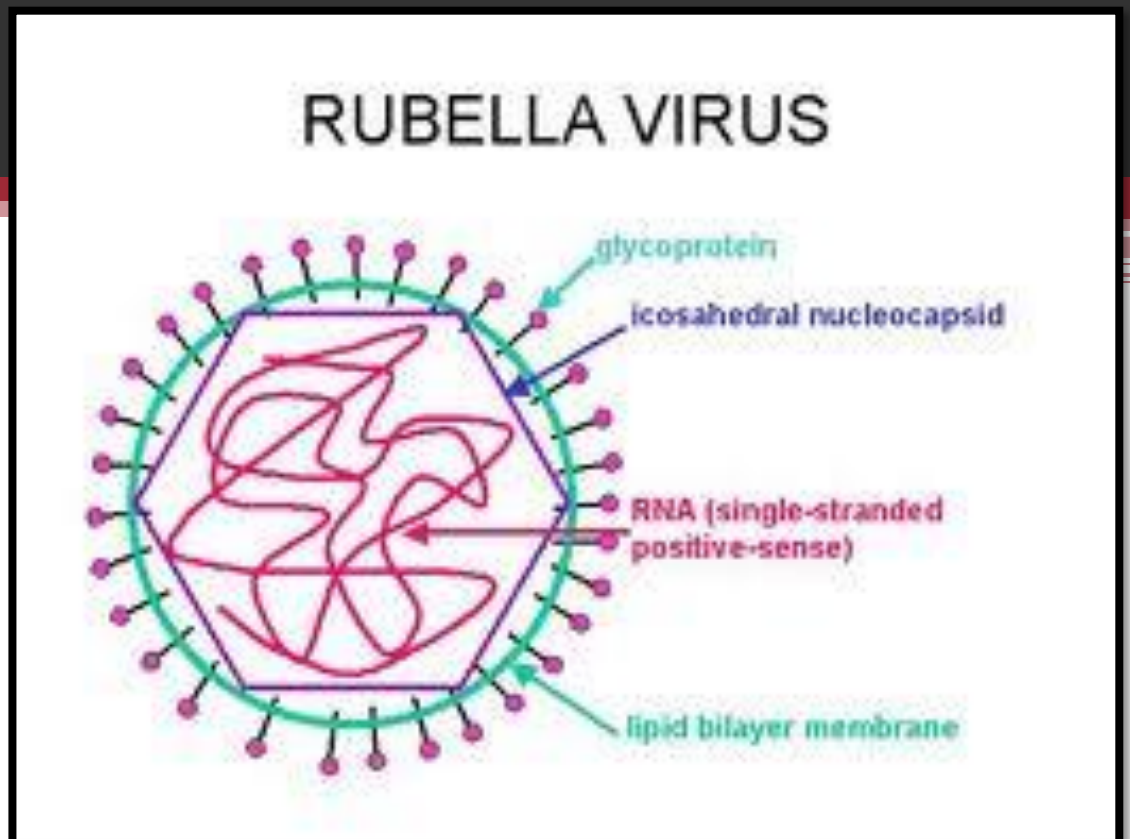


In India, Edmonton-Zagreb (E-Z strain) 5ml of vaccine subcutaneously.

1st dose: 9mths

2nd dose: 15-18 mths

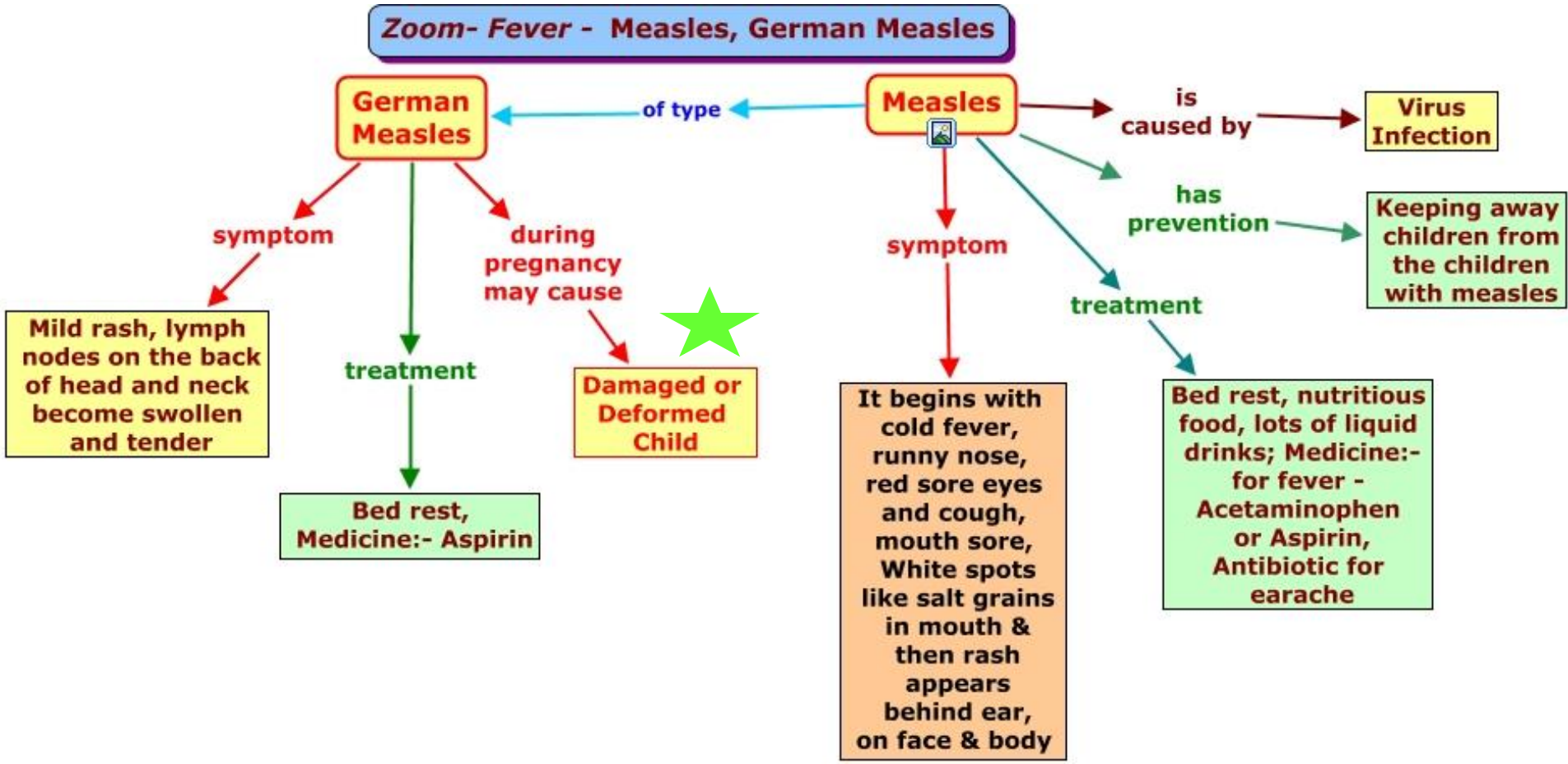
RNA Viruses: Togavirus Rubella



Rubella (German Measles):

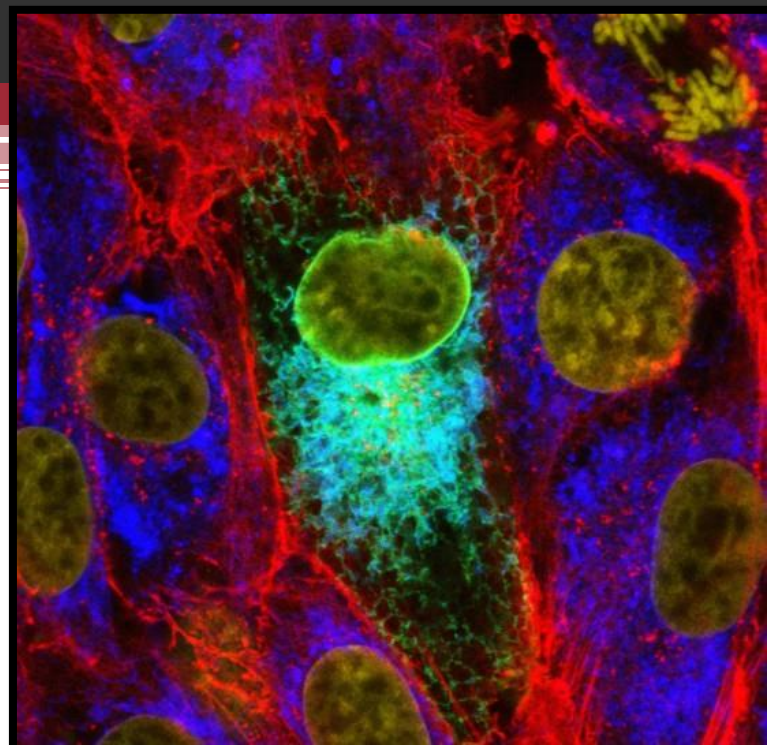
- Difference from Ruboela (Measles):

1. Koplik's spots absent
2. Oral mucous membrane not inflamed.
3. Complications are rare, except in 1st trimester of pregnancy resulting in congenital defects as:
   - enamel hypoplasia
   - blindness
   - deafness
   - cardio-vascular abnormalities

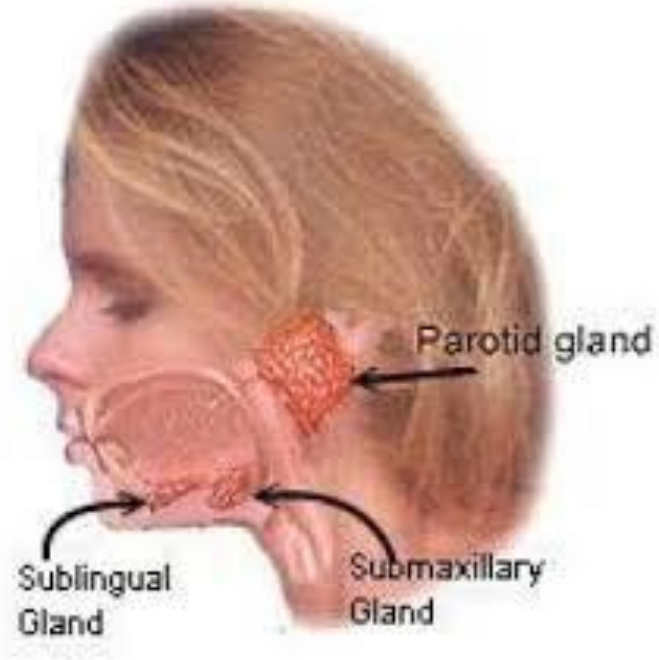

Zoom- Fever - Measles, German Measles
German Measles
of type
Measles
is caused by
Virus Infection
has prevention
Keeping away children from the children with measles
symptom
during pregnancy may cause
symptom
treatment
treatment
Mild rash, lymph nodes on the back of head and neck become swollen and tender
Bed rest, Medicine:- Aspirin
Damaged or Deformed Child
It begins with cold fever, runny nose, red sore eyes and cough, mouth sore, White spots like salt grains in mouth & then rash appears behind ear, on face & body
Bed rest, nutritious food, lots of liquid drinks; Medicine:- for fever - Acetaminophen or Aspirin, Antibiotic for earache

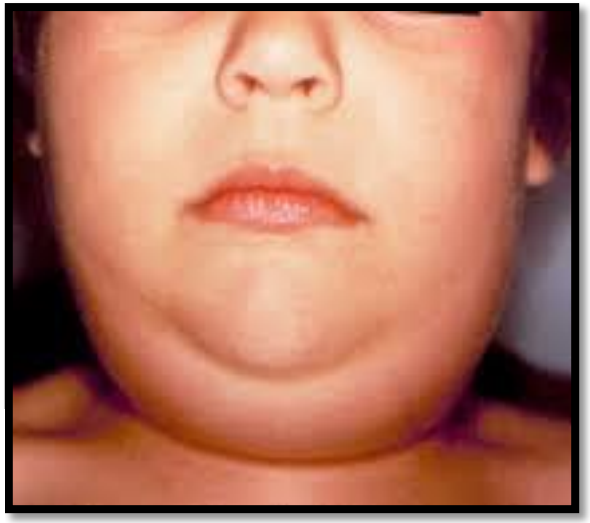
Mumps (Epidemic Parotitis)

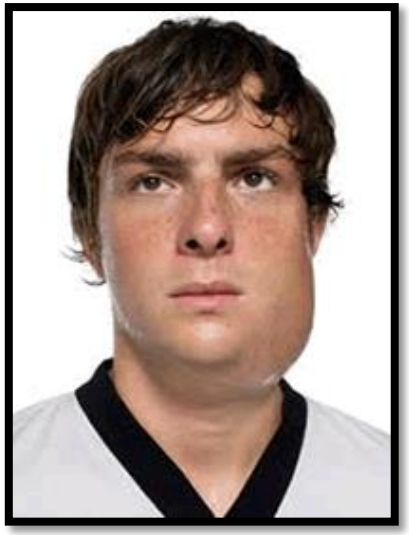
Caused by Paramyxovirus

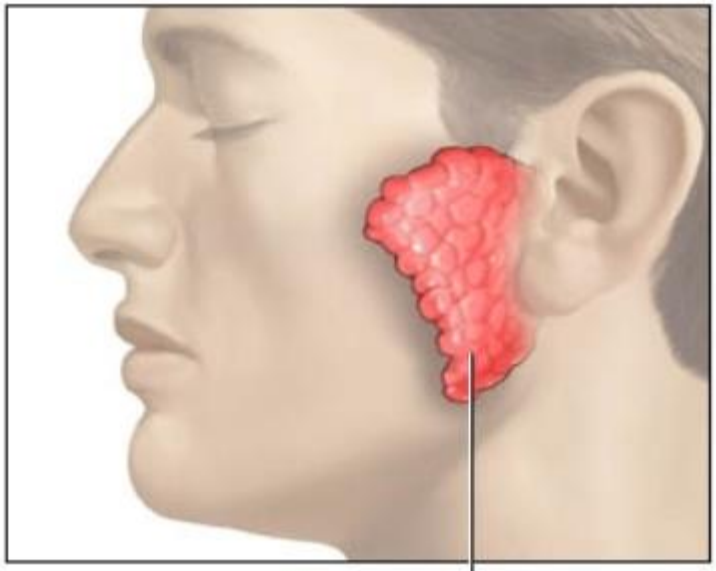


Acute, contagious viral infection. Unilateral or bilateral involvement of salivary glands









Swollen parotid gland

Pathogenesis

Virus enters respiratory tract

Virus grows in salivary glands and local lymphoid tissue

Virus spreads to spleen and distant lymphoid tissue

7-10 days

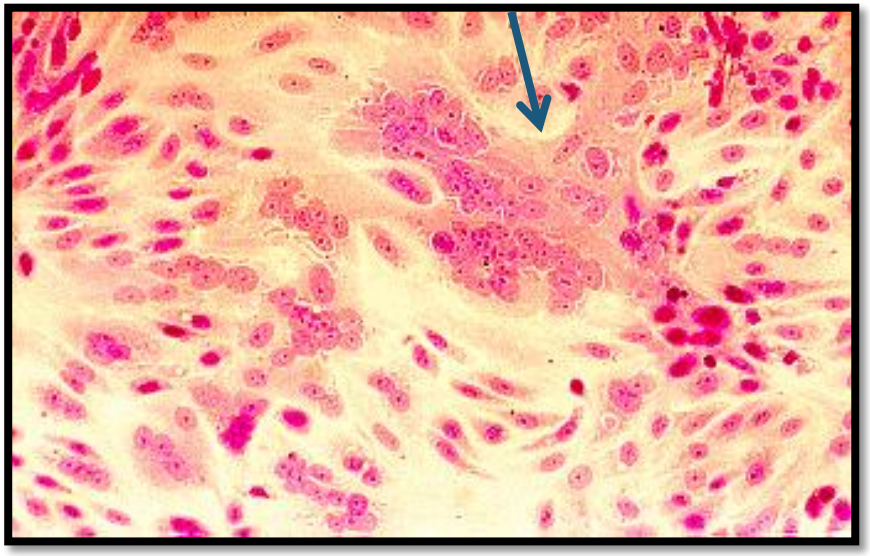
Viremia

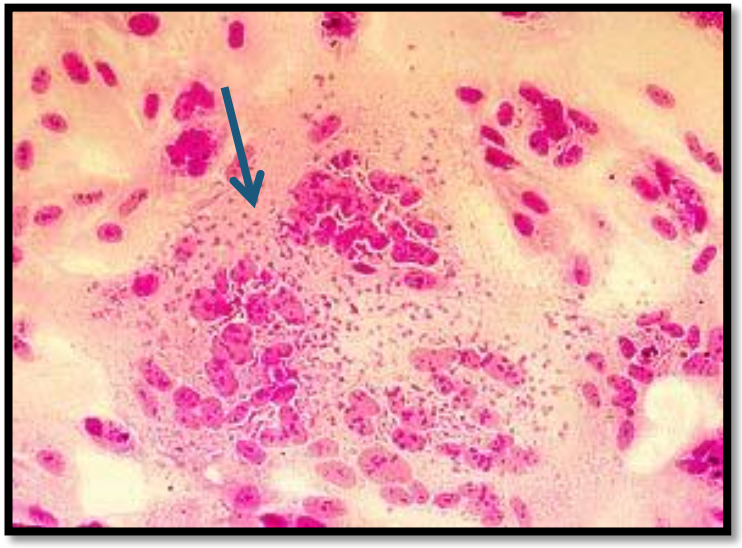
Approx 15 days

Virus spreads throughout body to testes, ovary, pancreas, thyroid, salivary glands

18 days and after

DISEASE





Perivascular & interstitial mononuclear cell infiltrates, edema & necrosis of acinar & epithelial duct cells

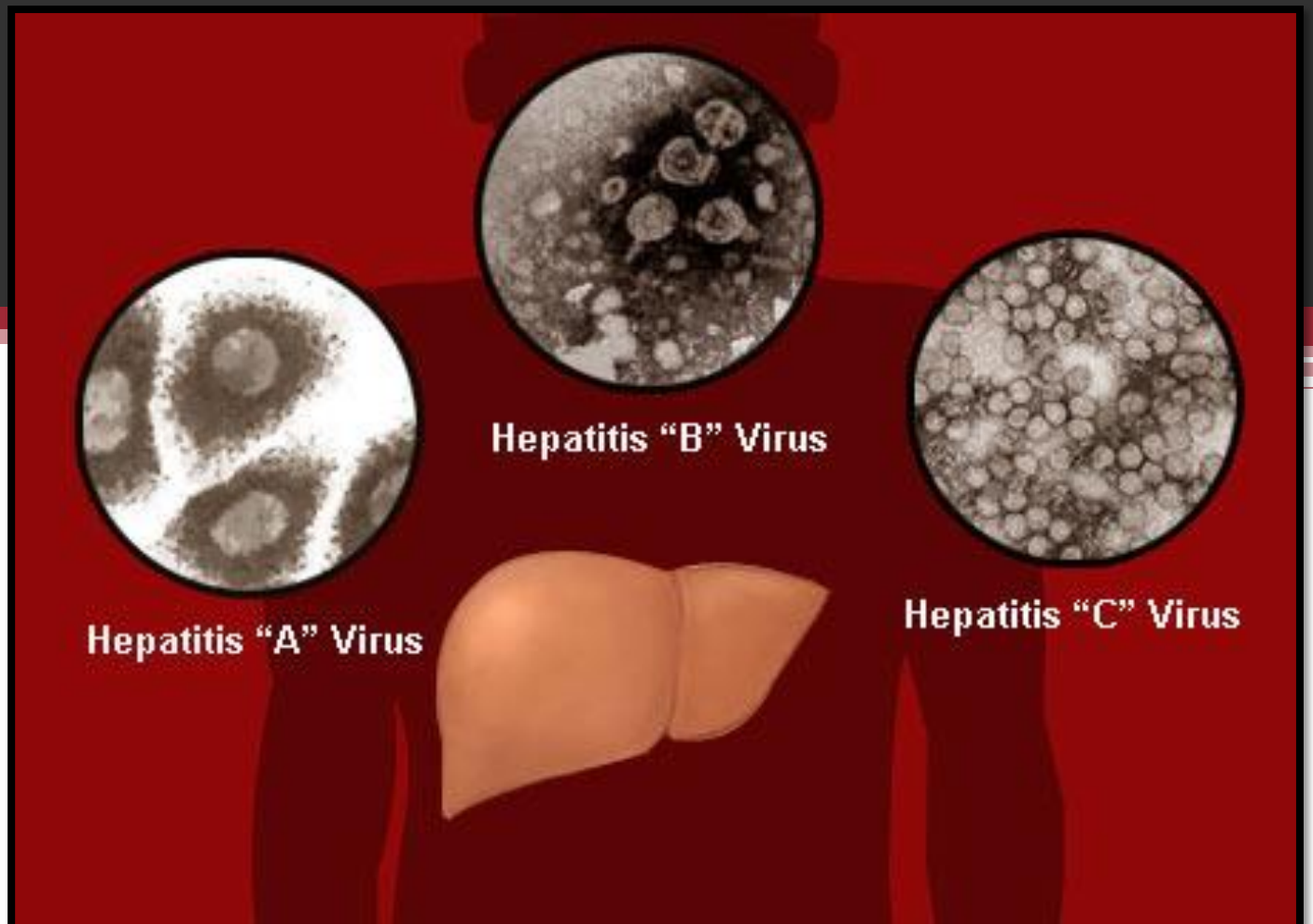
Diagnosis: Swabs from saliva, CSF & throat
ELISA
Serum amylase is elevated

Treatment: Vaccination

Complications:

1. Death due to CNS or cardiac involvement
2. In adult males: Orchitis leading to complete sterility
3. In pregnancy then leads to abortion

Hepatitis Viruses

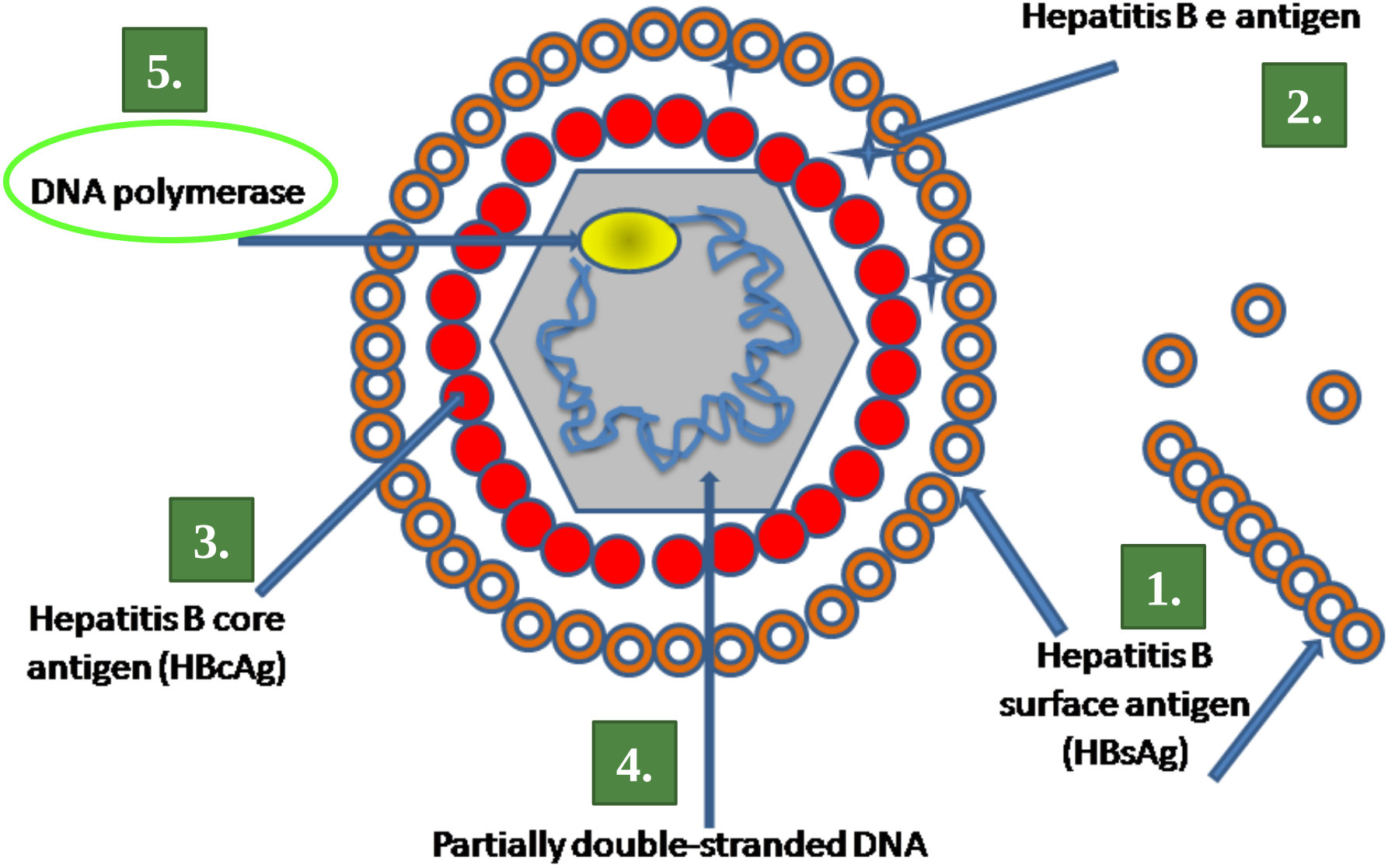


Viral Hepatitis - Overview

	Type of Hepatitis				
	A	B	C	D	E
Source of virus	feces	blood/ blood-derived body fluids	blood/ blood-derived body fluids	blood/ blood-derived body fluids	feces
Route of transmission	fecal-oral	percutaneous permucosal	percutaneous permucosal	percutaneous permucosal	fecal-oral
Chronic infection	no	yes	yes	yes	no
Prevention	pre/post-exposure immunization	pre/post-exposure immunization	blood donor screening; risk behavior modification	pre/post-exposure immunization; risk behavior modification	ensure safe drinking water

CDC

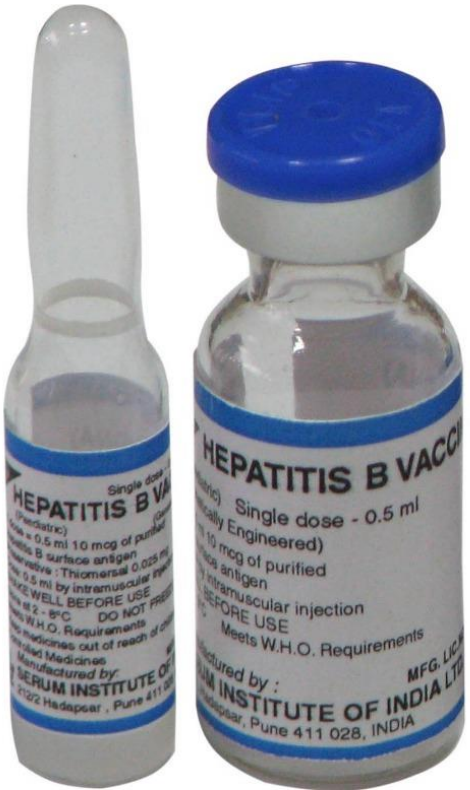
Hepatitis B: Hepadnaviridae



HBV

- Chronic Hepatitis
- Cirrhosis
- Primary Hepatic Cancer

Hepato-cellular Carcinoma is the only human cancer which is vaccine preventable



Latest Updates

Ref: Pleiotrophic Mechanisms of Virus Survival & Persistence.
Craig Miller
Oral Surg Oral Med Oral Patho Oral Radio Endod; 2005; 100:27-36

- Viruses develop numerous strategies for avoiding host defences during infection as:

1. Regulating apoptosis
2. Inhibiting interferon production
3. Modulating the MHC-I
4. Limiting cytokine & chemokine production

Ref: Pleiotrophic Mechanisms of Virus Survival & Persistence.

Craig Miller

Oral Surg Oral Med Oral Patho Oral Radio Endod; 2005; 100:27-36

II. Regulating apoptosis: Inhibiting interferon production:

EBV, HPV & Adenoviruses encode: proteins that

1. Targeting p53
2. Target JAK-STAT signaling pathways required for IFN production.
3. Produce caspase inhibitors
4. Producing Viral Bcl-2 homologs

III. Modulating the MHC-I:

Herpesviruses

a) Encode FLICE-inhibitory proteins that block Trail mediated cell death
b) Encode proteins that degrade & down-regulate MHC-I leading to inhibition of apoptosis
c) protein synthesis by gene

HSV produces: → vMIA (inhibits off apoptosis)

CMV → UL36

HSV-1 encode → ICP4 & ICP27 (anti-apoptotic agents), modulate apoptosis at several levels.

Viral Host Shut Off

Ref: Pleiotrophic Mechanisms of Virus Survival & Persistence.

Craig Miller
Oral Surg Oral Med Oral Patho Oral Radio Endod; 2005; 100:27-36

- **Viral Persistence:** as they are able to down-regulate key processes that if left unattended would result in cell death.

- HSV-1 & -2: ability to auto-regulate 2 life-cycles.

↓

Lytic infection in epithelium

↓

Latent infection of neurons

HSV encodes proteins LANA & latency–associated transcripts (LATs) that appear to regulate viral transcription during latency.

Ref: Comparison of the Tzanck test and polymerase chain reaction in the diagnosis of cutaneous herpes simplex and varicella zoster virus infections.

Atilla Ozcan MD

International Journal of Dermatology, 2007, vol. 46 (11); 1177–1179

- Although PCR was superior to the Tzanck test, the Tzanck test has also been proven to be a reliable diagnostic method, with a sensitivity of 76.9% and a specificity of 100%.
- They have recommend the use of Tzanck test as :

1. Easy
2. Quick
3. Reproducible
4. Inexpensive diagnostic test

- So more often in dermatologic practice, especially in cutaneous herpes virus infections.

Ref: Histopathology For The Diagnosis Of Infectious Diseases

E Gupta

Indian Journal of Medical Microbiology, (2009) 27(2): 100-6

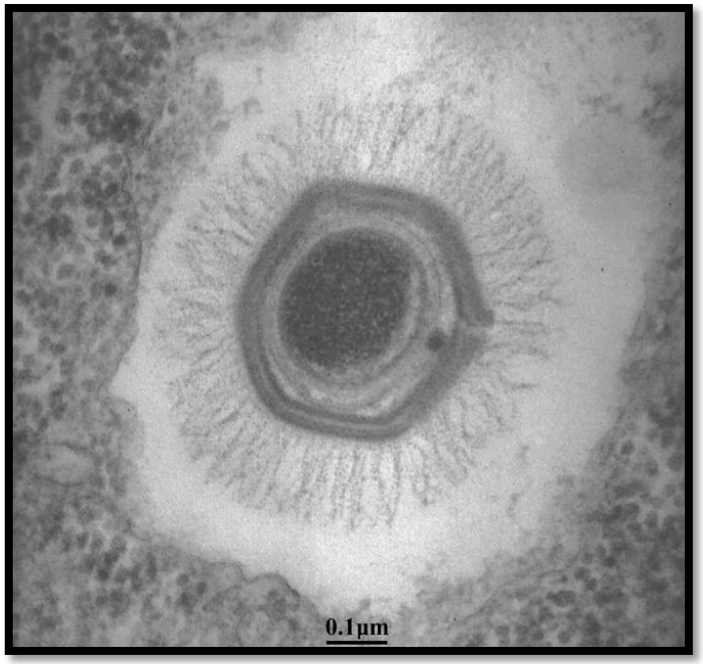
- Histopathological examination of tissue biopsies for the identification of infectious organisms is a very important diagnostic tool.

Table 1: Various stains used for detecting virus in clinical material by direct microscopy

Area of smear preparation	Staining method	Viruses
Cutaneous/mucocutaneous/skin biopsy	Tzanck smear, Giemsa, H and E, IF	HSV,VZV, *Molluscum contagiosum*
Uterine cervix	Papanicolaou	HPV
Broncho alveolar lavage	Giemsa, Papanicolaou	CMV, Adeno, RSV, Measles, HSV or VZV
Bone marrow aspirate	Giemsa	Parvo virus B19
Brain tissue	Seller, IF, H and E	Rabies, HSV, CMV, SSPE, PML
Urinary sediments	Giemsa, IF	CMV, BK
Nasopharyngeal aspirates	IF	Respiratory viruses

Ref: Virus Taxonomy: Ninth Report of the International Committee on Taxonomy of Viruses

International Committee on Taxonomy of Viruses; 2012



The Double Stranded DNA Viruses

GENUS: *MIMIVIRUS*

Type species: ***Acanthamoeba polyphaga mimivirus***

Characteristic features:

1. The presence of many proteins never seen in any other virus is one of the unique features of mimivirus.
2. In addition to the full DNA replication and transcription apparatus usually found in large eukaryotic DNA viruses (such as the poxviruses).

Ref: Virus Taxonomy: Ninth Report of the International Committee on Taxonomy of Viruses

International Committee on Taxonomy of Viruses; 2012

- Mimivirus was isolated in the context of a pneumonia epidemic but more specific PCR-based studies failed to detect mimivirus in large numbers of pneumonia patients.

- Size of its particle, mimivirus is internalized by various professional phagocytic cells, including human macrophages *in vitro*.

- At the moment, there is little evidence that mimivirus is a human pathogen.

Ref: World Health Officials Debate Whether To Destroy Last Existing Samples of Smallpox

Rebecca Boyle

Posted 04.13.2011

- Two labs possess the last known live samples of the variola virus — the Centers for Disease Control and Prevention in Atlanta & a Russian facility in Siberia.

- Officials in the U.S. and Russia have said they will fight efforts to set a destruction date, arguing the viruses are needed for research and to guard against bioterrorism.

- Some fear nations like North Korea or Iran may possess secret samples, although those countries deny it.

Ref: Update on the current status of cytomegalovirus vaccines
Heungsup Sung
Expert Rev Vaccines. 2010 November ; 9(11): 1303–1314.

- CMV is the most commonly recognized cause of congenital viral infection in developed countries.
- There are no licensed HCMV vaccines currently available.

- Recently reported results of a Phase II trial of a glycoprotein B vaccine for the prevention of HCMV infection in sero-negative women of childbearing age.

- Recent advances in the study of the biology of HCMV, particularly with respect to epithelial & endothelial cell entry of the virus, which have implications for future vaccine design.

Ref: Hepatitis B virus-induced Hepatocellular Carcinoma.
Tong HV
J Viral Hepato. 2013 Oct;20(10):687-98

- Hepatitis B virus infection is a high-risk factor for hepatocellular carcinoma.

- The human major histocompatibility complex class I chain-related gene A (MICA) is a ligand that plays a crucial role in modulating innate immune responses, tumour surveillance and regulate disease susceptibility during HBV infection.

Ref: The role of Epstein-Barr virus in cancer.
Pattle SB
Expert Opinion Biological Theory; 2006 Nov;6(11):1193-205.

- EBV has two distinct life cycles in the human host:

1. Lytic form: of infection that produces new infectious virions.
2. Latent form: of infection that allows the virus to persist in a dormant state for the lifetime of the host.

- Its presence in various stages of B-cell development, and its ability to infect certain epithelial cells, can have pathogenic consequences, and can contribute to a diverse group of lymphomas and carcinomas.

EBV has evolved a life cycle that mimics the natural differentiation pathway of antigen-activated B cells, giving the virus access to its site of latent infection, the resting memory B cell.

Ref: Epstein-Barr Virus in Burkitt's Lymphoma.
Kathryn T. Bieging
Cell Cycle. 2010 March ; 9(5): 901–908.

- Burkitt's lymphoma (BL) is characterized by translocation of the *MYC gene to an immunoglobulin* locus.
- Inactivation of the p53 pathway is a major step to tumor formation.
- All EBV-associated malignancies is the expression of one or more latent membrane proteins. Of the three latent membrane proteins, have known to have oncogenic activity.

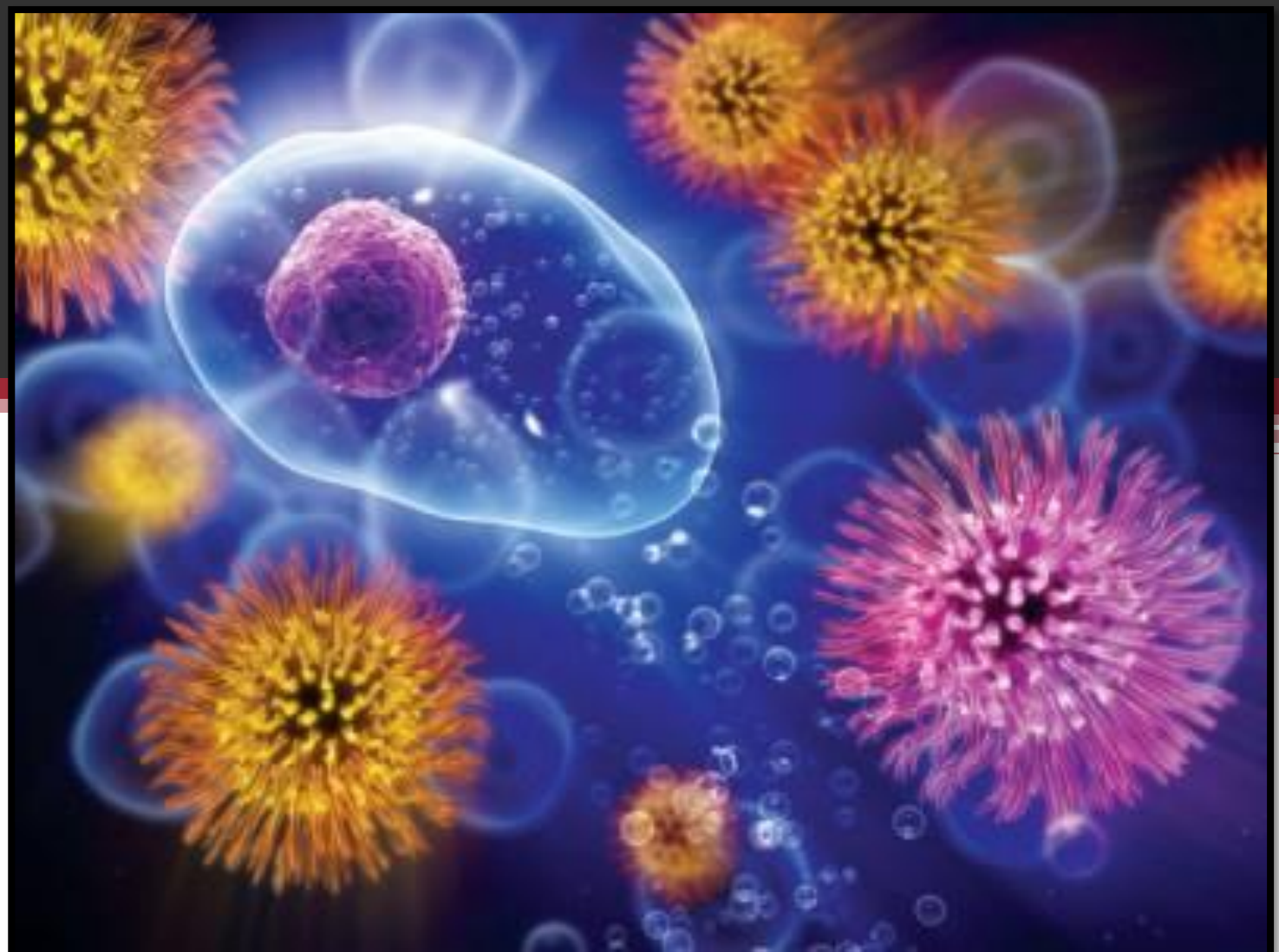
Ref: Nasopharyngeal Carcinoma: The Role of the Epstein-Barr Virus

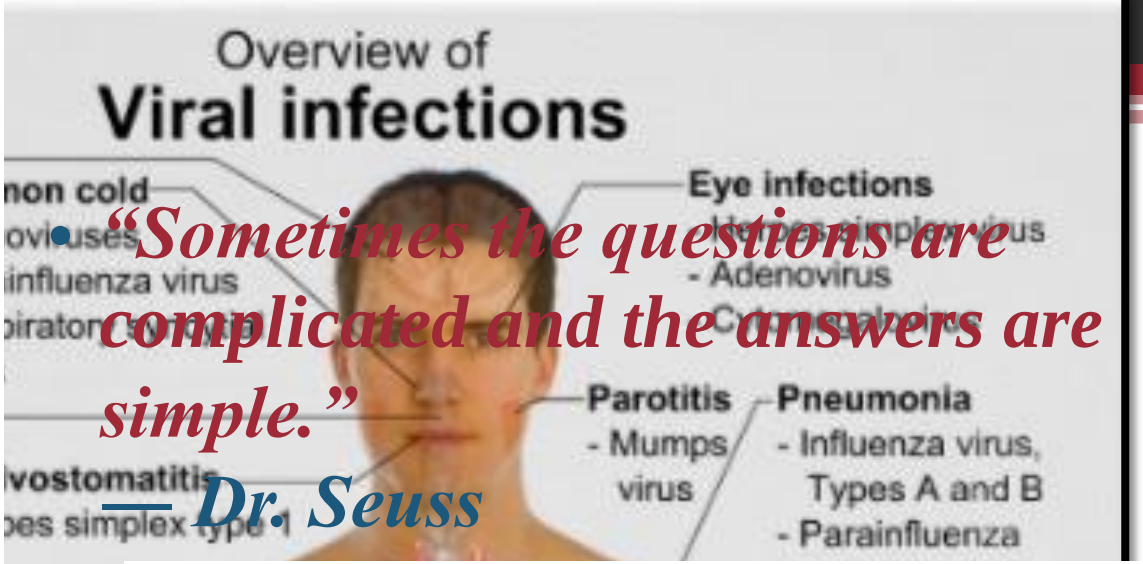
Eugene A. Chu

Medscape J Med. 2008; 10(7): 165.

- The etiology of NPC is multi-factorial and includes genetic susceptibility, exposure to carcinogens, and prior infection with the Epstein-Barr virus (EBV).
- Though EBV is certainly implicated in the pathogenesis of NPC, the exact mechanism and pathway by which it exerts its effects are unknown.
- EBV studies, circulating plasma EBV DNA levels, have shown utility in staging, prognosis, and post-therapeutic monitoring.
- Patients with high plasma EBV DNA levels are at increased risk for distant metastasis.

Conclusion





"Sometimes the questions are complicated and the answers are simple."

— Dr. Seuss

- Hepatitis virus types A, B, C, D,

Skin infections

- Varicella zoster vi
- Human herpesvir
- Smallpox
- Molluscum contag
- Human papilloma
- Parvovirus B19
- Rubella
- Measles
- Coxsackie A virus

Glossary of Vaccinations	
BCG	Tuberculosis
DPT	Diptheria, Pertussis and Tetanus
HBV	Hepatitis B
HiB	Haemophilus influenzae type B (Meningitis, Pneumonia, Epiglottitis)
IPV	Polio (given by injection)
MMR	Measles, Mumps and Rubella
OPV	Polio (given orally)
Pneumococcal C	Pneumonia
Varicella	Chicken Pox

References

1. Textbook of Microbiology – Anant Narayan
2. Textbook of Pathology – Robbins
3. Textbook of Pathology – Harsh Mohan
4. Textbook of Oral Pathology – Shafer
5. Textbook of Oral Pathology – Neville
6. 11 Reference Articles included.

Thank You