Virus

Virus RNA

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Virus-virus RNA

1. Paramyxoviridae

- **Parainfluenza viruses**
- **Mumps virus**
- **Measles virus**
- **Respiratory Syncytial virus**
- **Human Metapneumovirus**

2. Orthomyxoviridae

3. Picornaviridae

- **Enteroviruses**
- **Rhinovirises**

4. Retroviridae

5. Rhabdoviridae

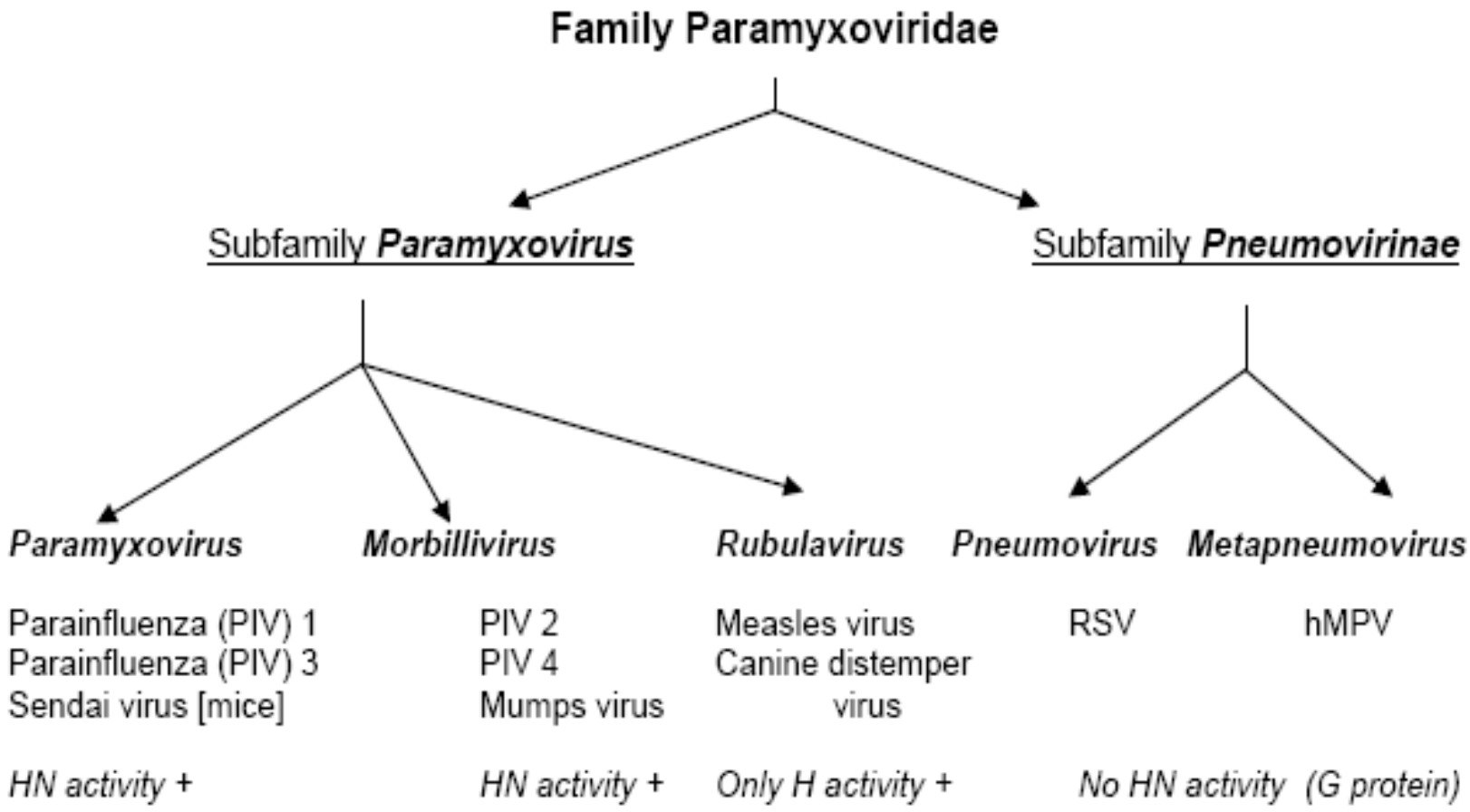
6. Togaviridae

Virus-virus RNA

7. Flaviviridae **8. Coronaviridae** **9. Caliciviridae** **10. Arenavirus** **11. Bunyaviridae** **12. Reoviridae** **- Rotavirus**	

VIRUS RNA

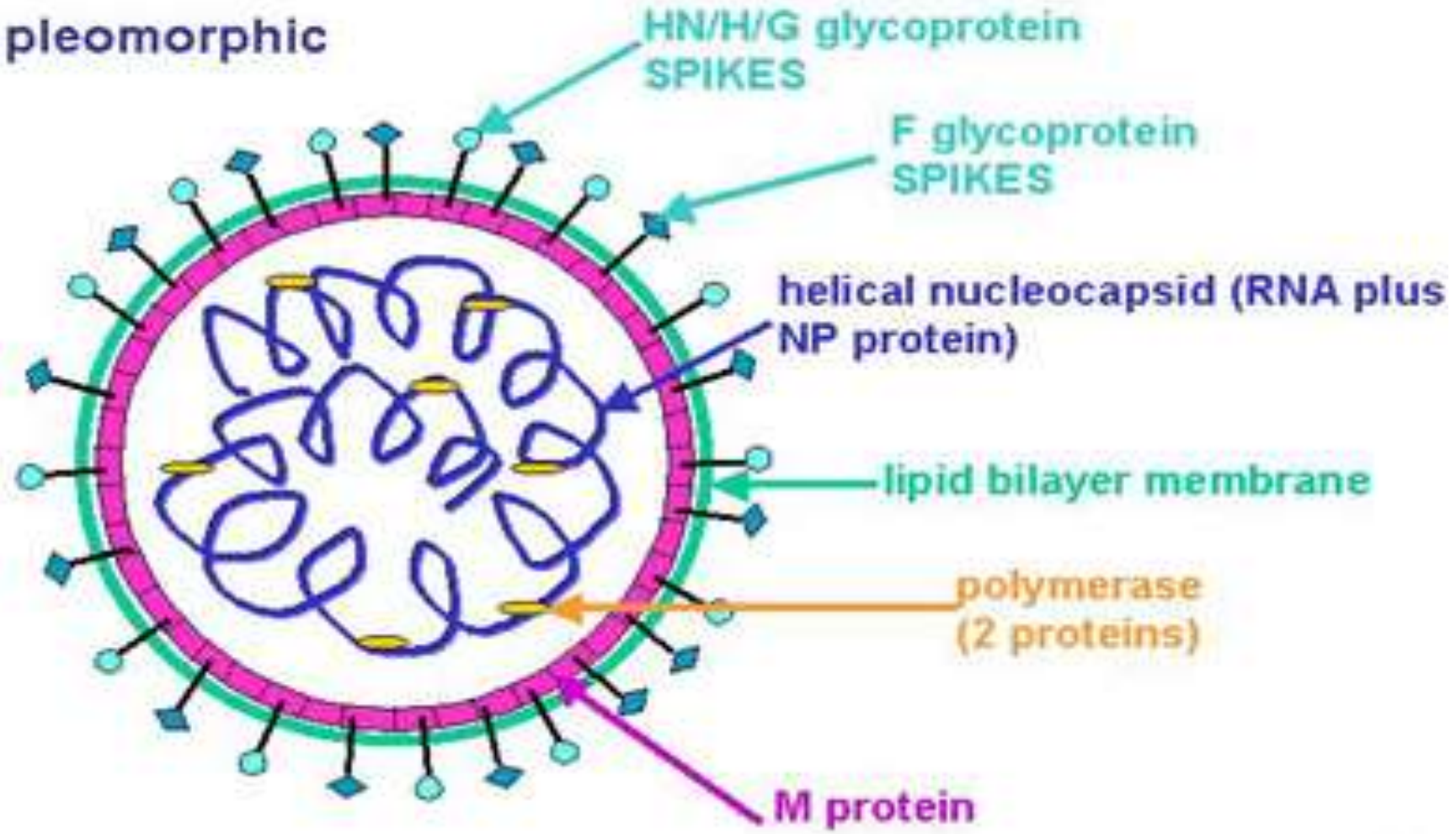
PARAMYXOVIRIDAE
(PARAINFLUENZ VIRUSES)


Family Paramyxoviridae
Subfamily Paramyxovirus
Subfamily Pneumovirinae
Paramyxovirus
Morbillivirus
Rubulavirus
Pneumovirus
Metapneumovirus
Parainfluenza (PIV) 1
Parainfluenza (PIV) 3
Sendai virus [mice]
PIV 2
PIV 4
Mumps virus
Measles virus
Canine distemper virus
RSV
hMPV
HN activity +
HN activity +
Only H activity +
No HN activity (G protein)

STRUCTURE

- 150-300 nm in size
- Shape - spherical or pleomorphic
- Enveloped virus
- Nucleocapsid has RNA is associated with nucleoprotein (NP), Phosphoprotein (P) and Large protein (L)
- Unsegmented, negative sense, helical ss RNA

PARAMYXOVIRUSES



PROPERTIES

- Labile, but survive on surfaces for several hours
- Highly infectious
- Susceptible to destruction by soap and water, disinfectants
- Hemadsorbing virus
- Antigenically stable

PATHOGENESIS AND REPLICATION

- Viral Attachment- HN glycoprotein and F protein
- Nasopharyngeal mucosa
- Spread to lower respiratory tract in 1-3 days
- Uncoating of virus in cytoplasm
- **PIV penyebab infeksi respiratory**
- Infeksi primer pada usia
- **Transmisi melalui droplets, aerosols dan direct contact**

CLINICAL FEATURES

- Incubation : 2-6 hari
- Infeksi primar dan reinfections
- Reinfections gejala klinik lebih berat
- PIVs-1 dan 2 : penyakit serius (2 – 4 th)
- **PIVs-1 : croup (*laryngotracheobronchial*) pada anak**
- **PIVs-3 : *bronchiolitis* and *pneumonia* pada bayi dan RSV**
- PIVs-4 : URI

CROUP
Acute laryngotracheobronchitis

- Age:- typically <6 th
- larynx, area subglotis dan trachea
- Gejala klinis: **demam, batuk, suara serak, stridor**
- Thorax photo : steeple sign

Subglottic Narrowing in Croup
(AP Radiograph)

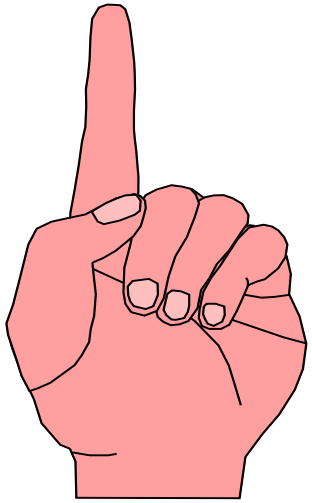
PIV Infections - Lab. diagnosis

- *Antigen detection* in nasopharyngeal secretions - ELISA/DFA
- *Viral culture* - PMK, HEK cell lines, CPE and HA/HAI
- *Serology* - 4 fold change in HAI antibody titers
- *DNA Amplification*-PCR ?

CROUP - Treatment

- Humidification
- Epinephrine
- Steroids (some cases)

Prevention



- Hand washing (virus dilemahkan sabun dan air)
- Pencegahan : kontaminasi permukaan
- Hindari inokulasi dimata, mulut dan hidung

VIRUS RNA

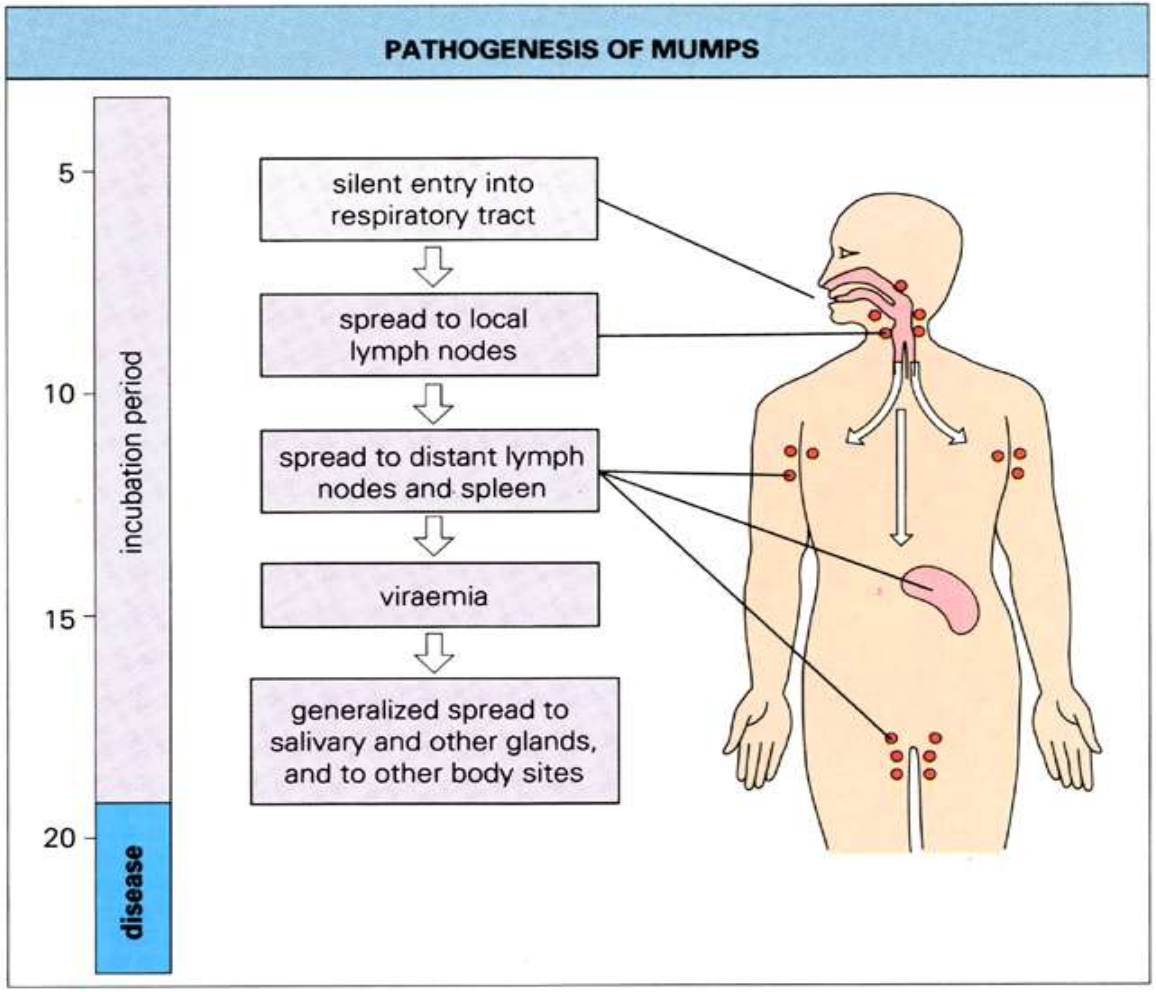
PARAMYXOVIRUS
(MUMPS)

MUMPS

Parotitis Epidemica = Gondong

Pathogenesis

- Transmisi respirasi dan air liur
- Infection awal pada bagian pernapasan atas
- Viremia dan infeksi pada kelenjar parotid



Mims et al., Medical Microbiology 1993

Mumps Clinical Features

Incubation : 14-18 hari

Gejala nonspesifik: myalgia, malaise, headache, low-grade fever, Parotitis 30%-40%

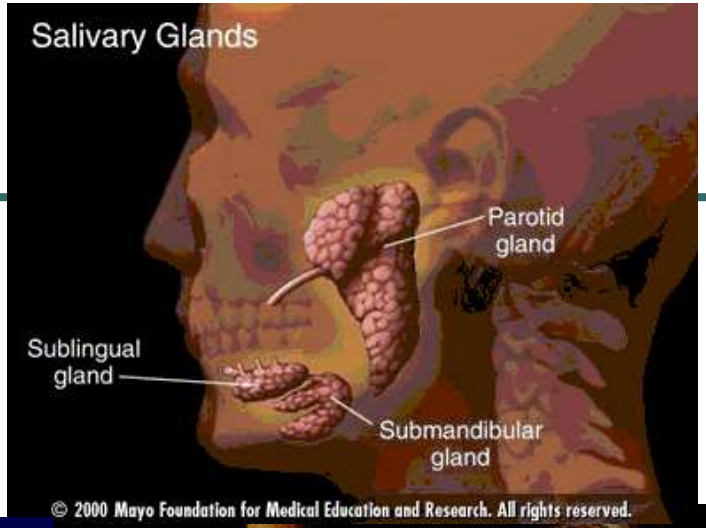
20% tidak bergejala

Penyakit anak yang ringan dengan pembengkakan kelenjar paratoid (biasanya satu) dan demam

Meningitis aseptik; beberapa kasus sequalae dan tuli unilateral

Testes - orchitis : testicular atrophy, oophoritis (postpubertal males)


GREG CAN'T PLAY
MUMPS


Salivary Glands
Parotid gland
Sublingual gland
Submandibular gland
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site of growth	result	comment
Salivary glands	inflammation, parotitis virus shed in saliva (from 3 days before to 6 days after symptoms)	often absent; can be unilateral
Meninges Brain	meningitis encephalitis (up to 7 days after parotitis)	common (in about 10% cases) less common; complete recovery is the rule; nerve deafness is a rare complication
Kidney	virus present in urine	no clinical consequences
Testis, ovary	epididymo-orchitis; rigid tunica albuginea around testis makes orchitis more painful, more damaging, in male	common in adults (20% in adult males); often unilateral; not a significant cause of sterility
Pancreas	pancreatitis	rare complication (possible role in juvenile diabetes)
Mammary gland	virus detectable in milk; mastitis in 10% post-pubertal females	–
Thyroid	thyroiditis	rare
Myocardium	myocarditis	rare
Joints	arthritis	rare

Mims et al., Medical Microbiology 1993

Diagnosis, prevention, treatment

- Diagnosis – isolasi virus dngkultur sel; peningkatan titer antibodi
- Prevention - vaccine MMR = Mumps, Measles, Rubella
- Treatment – tidak ada

VIRUS RNA

PARAMYXOVIRIDAE
(MEASLES VIRUS)

Measles

Rubeola = morbili = campak

Penyakit pada anak

- **Rash, conjunctivitis**; kekebalan jangka panjang

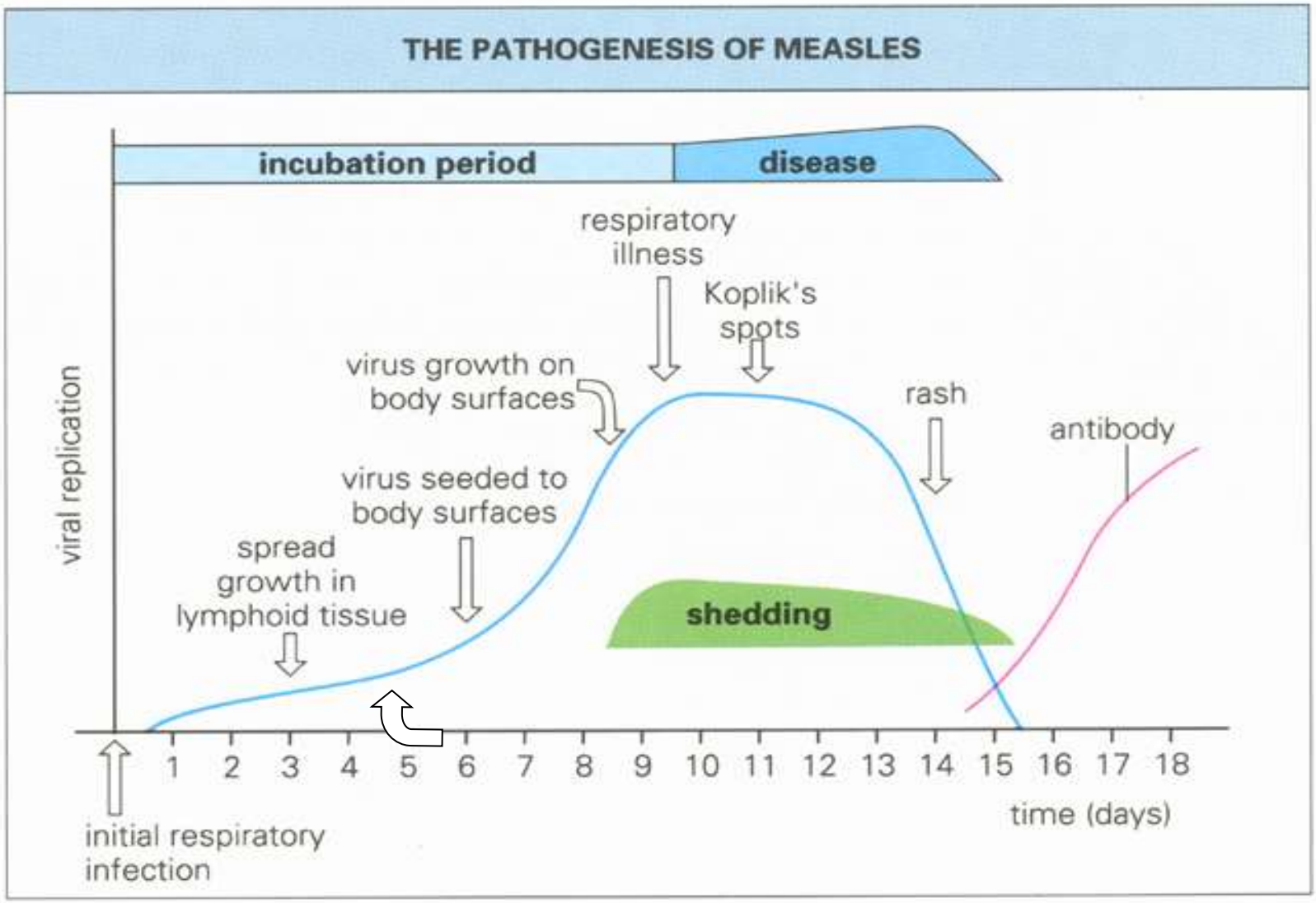
Komplikasi dan kematian

Kontrol : **immunisasi**

Inhalasi

Infeksi sel epitel saluran pernapasan – menyebar ke kelenjar lymph,sistem reticuloendothelial, multiplikasi di sel macrophages and lymphocytes

Virus berada di air mata, sekeresi hidung urine


THE PATHOGENESIS OF MEASLES
incubation period
disease
respiratory illness
Koplik's spots
virus growth on body surfaces
rash
antibody
virus seeded to body surfaces
spread growth in lymphoid tissue
shedding
viral replication
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18
time (days)
initial respiratory infection

Disease

- Sering pada anak
- Inkubasi 10 – 12 hari
- Masih infeksius setelah gejala muncul
- Acut febrile illness
- “flu like syndrome”
- Respiratory tract
    - rhinorrhea, cough

Disease

- **Koplik's spots**
  - Mucosa mulut : bercak tidak teratur dng bintik putih keabuan di mukosa bucal
- **Maculopapular rash**
  - T-cells → endothelial cells
  - setelah 1 – 2 hari gejala akut selesai
  - 10 – 14 hari sembuh biasanya rash lengkap
- **Conjunctivitis**
  - epithelial cells

Measles
-summary-

Recovery

- Fairly rapid
  - T-cell response important
  - agammaglobulinemia – recover
  - T-cell deficient, may be no rash, may be severe disease (life threatening)
- Gejala lebih berat pada dewasa

Complications

- Otitis
- Giant cell pneumonia (adult)
- Secondary bacterial infections
- More severe if malnourished and/or poor access to medical care
- Measles encephalitis (subacute aclerosing panencephalitis (SSPE))
  - 1/1000 cases
  - Sequelae : deafness, seizures, mental disorders

THE CLINICAL IMPACT OF MEASLES		
site of virus growth	**well nourished child good medical care**	**malnourished child poor medical care**
Lung	temporary respiratory illness	life threatening pneumonia
Ear	otitis media quite common	otitis media commoner more severe
Oral mucosa	Koplik's spots	severe ulcerating lesions
Conjunctiva	conjunctivitis	severe corneal lesions secondary bacterial infection blindness may result
Skin	maculopapular rash	haemorrhagic rashes may occur ('black–measles')
Intestinal tract	no lesions	diarrhoea – exacerbates malnutrition, halts growth, impairs recovery
Urinary tract	virus detectable in urine	no known complications
Overall impact	**serious disease in a small proportion of those infected**	**major cause of death in childhood (estimated 1.5 million deaths/yr worldwide)**

Diagnosis

- Serodiagnosis
  - Significant increase in IgG (need two samples)
  - Positive for IgM
- Isolation

Prevention and Treatment

- LIVE ATTENUATED VACCINE (MMR)
  - Does not spread to contacts
  - Can cause problems in immuno-suppressed
- IMMUNE SERUM GLOBULIN
- SUPPORTIVE CARE

VIRUS RNA

PARAMYXOVIRUS

(Respiratory Synctial Virus /RSV)

Respiratory Synctial Virus (RSV)

- Mirip dengan paramyxovirus, tidak memiliki hemagglutin dan neuraminidase
- **Infeksi epitel saluran pernapasan**
- **No viremia**
- Menyebabkan pembentukan synctia, respon imunologis mengarah ke patologi

Respiratory Synctial Virus (RSV)

Symptoms

- Incubasi 2-8 hari
- Virus hidup dipermukaan hingga 6 jam
- **Transmisi : droplets, fingers, fomites**
- Infeksi Nosocomial
- **Bayi dng LRI dan penyebab croup, bronchitis, bronchiolitis, interstisial pneumonia**
- “Common cold” - pilek
- Pada bayi dan anak : infeksi saluran pernapasan akut yang paling fatal

Clinical Features

Upper Respiratory Infection

Fever

Rhinitis

Pharyngitis

Lower Respiratory Infection- Bronchiolitis, Pneumonia

- Cough
- Poor feeding, lethargy
- Hypoxemia
- Respiratory Distress (tachypnea, retractions)
- Apnea
- Caracteristic on radiography : hyperinflation of the lungs

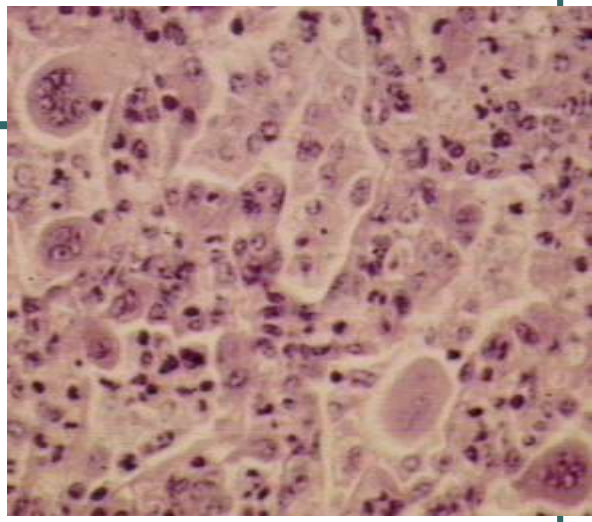
Diagnosis, treatment, control

- Diagnosis - culture is difficult; ELISA test for virus in nasal washings (nasal and tracheo-bronchial secretions, swabs, or aspirates, transport in viral culture medium and on ice)

- Treatment - usually treatments for symptoms (respiratory therapy); a guanosine analogue (ribavarin) is used in premature infants, immunocomprised patients

- Control - no effective vaccine is available

Diagnosis- methods



- Viral isolation

  PRMK, LLLC-MK-2

  CPE in 2-5 days

  Shell vial technique with immunofluoresence

- Antigen detection

  EIA, RIA, IF

- Antibody detection- not useful clinically

Treatment

- **Supportive**
- Fluids, oxygen, respiratory support, bronchodilators

- **Antiviral Agents**
- Ribavirin (*Virazole*), a synthetic guanosine analogue, given as an aerosol

Preventing Spread

Handwashing

Disinfection of surfaces

Gloves, masks, goggles, gowns

Isolation, and cohort nursing

Immunization

Human Metapneumovirus

- Clinical symptom : similar to infections RSV, influenza virus, parainfluenza virus
- URI – acut LRI and fever, no production cough, sore troat, wheezing, congestion, shortness of breath and lethargy
- Diagnosis
  - Culture
  - RT-PCR and fluorescent monoclonal antibodi
- Treatment
  - Supportive

VIRUS RNA

ORTHOMYXOVIRIDAE

Orthomyxoviridae

- The influenza virus type A, B, C
- Zoonotic infections (birds and mammals)
- Enveloped, ssRNA
- The mayor surface Ag : H dan N
- Antigenic variation :
  - **Antigenic drifts** (RNA replication errors of the virus =mutation accumulate)
  - **Antigenic shift** (a new H or N antigen)

Orthomyxoviridae

- Three major shifts :
  - Influenza A (H1N1) in 1981-1919 ; the Spanish flu, 2009 novel influenza A (H1N1), swine flu
  - Influenza A (H2N2) in 1957-1958 : the Asean flu
  - Influenza A (H3N2) since 1977 : the Hongkong flu, 1998 Influenza A (H5N1) the Avian flu → via contact with the birds migration
- Spread by aerosols
- The virus attack the ciliated epithelial cells living the respiratory tract → necrosis and sloughing of the cells

Orthomyxoviridae

Influenza A

- Incubation 1 – 4 days
- Chills, fever, headache, myalgia and anorexia
- Uper and lower respiratory tract infections
- Pyrexia (38 – 41˚C), systemic illness

Influenza B

- 3 days febrile illness with predominantly systemic symptome

Influenza C

- An afebrile URI

Orthomyxoviridae

- Diagnostic
  - Nasopharingeal swabs
  - DFA, EIA and optical immunoassays
  - Culture
- Terapi
  - Amantadine, rimantadine
  - Zanamivir (relenza), oseltamivir (tamiflu)

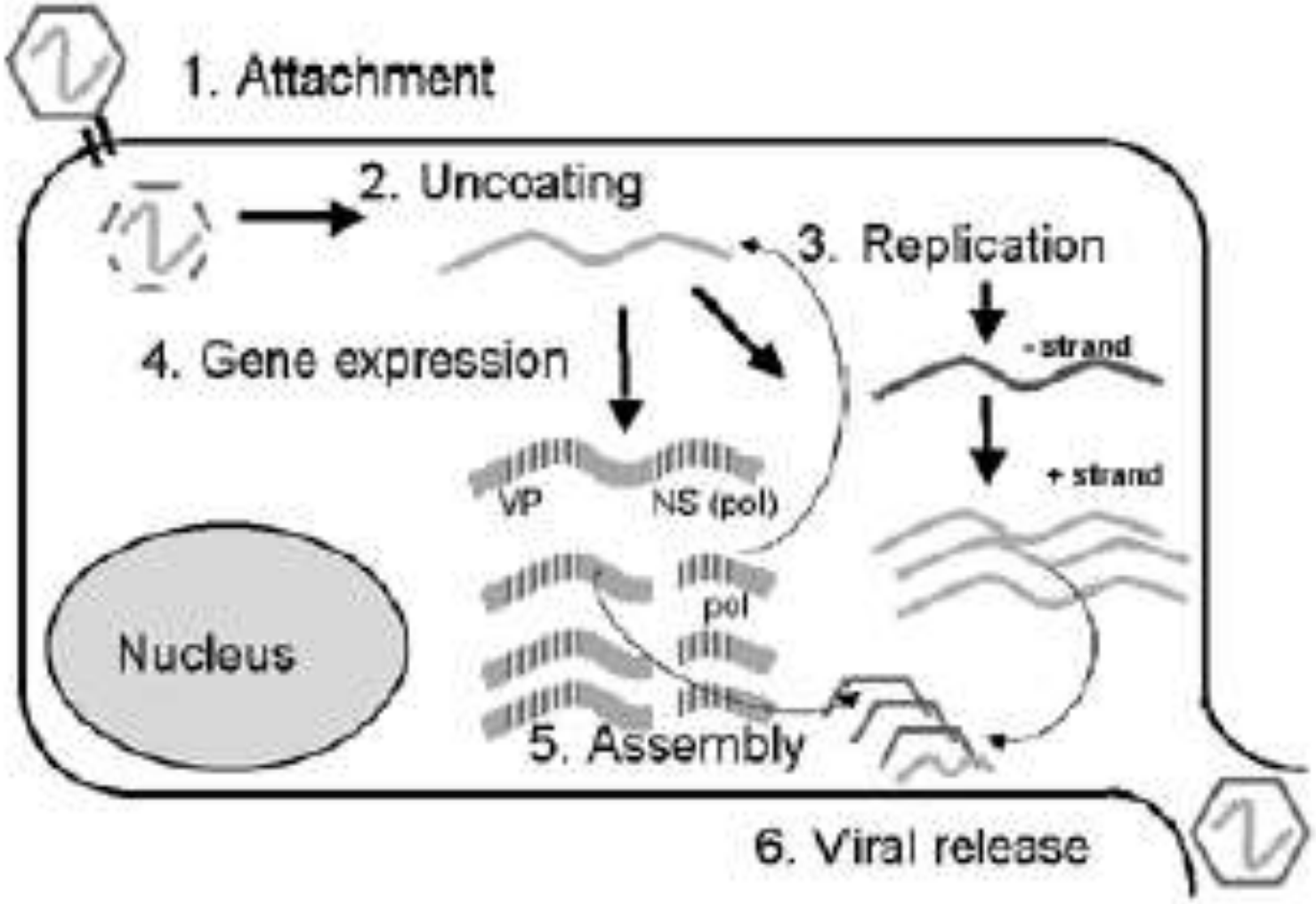
VIRUS RNA

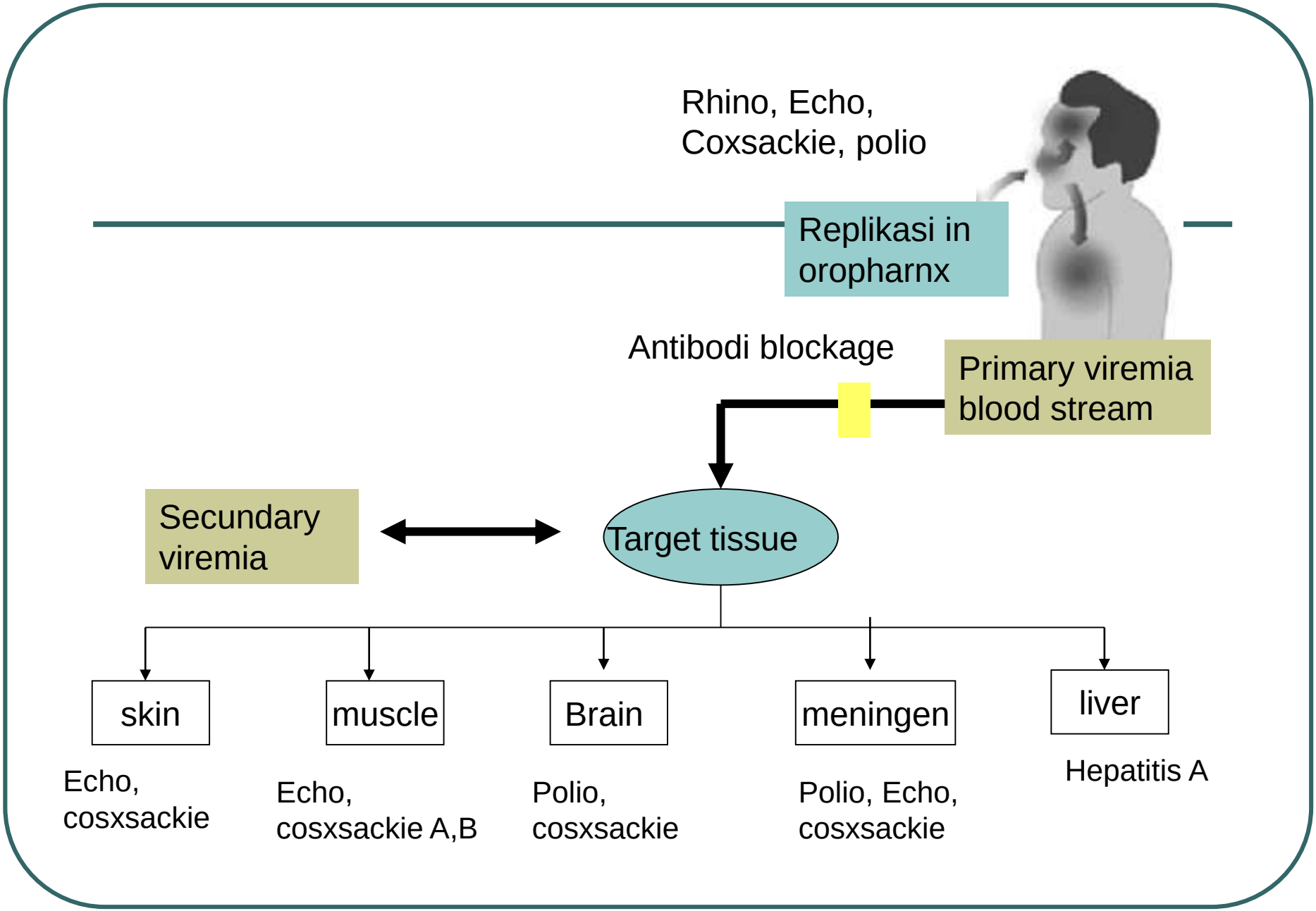
PICORNAVIRIDAE

Picornaviridae

- Belong to picornaviridae family
  - Aphthoviruses, enteroviruses, cardioviruses, rhinoviruses
- 4 subgroups
  - Polioviruses, coxsackieviruses, echoviruses, newer enteroviruses
- Non-enveloped, single-stranded, positive sense RNA viruses
- Enter through the gastrointestinal tract

Replication of Picornaviruses



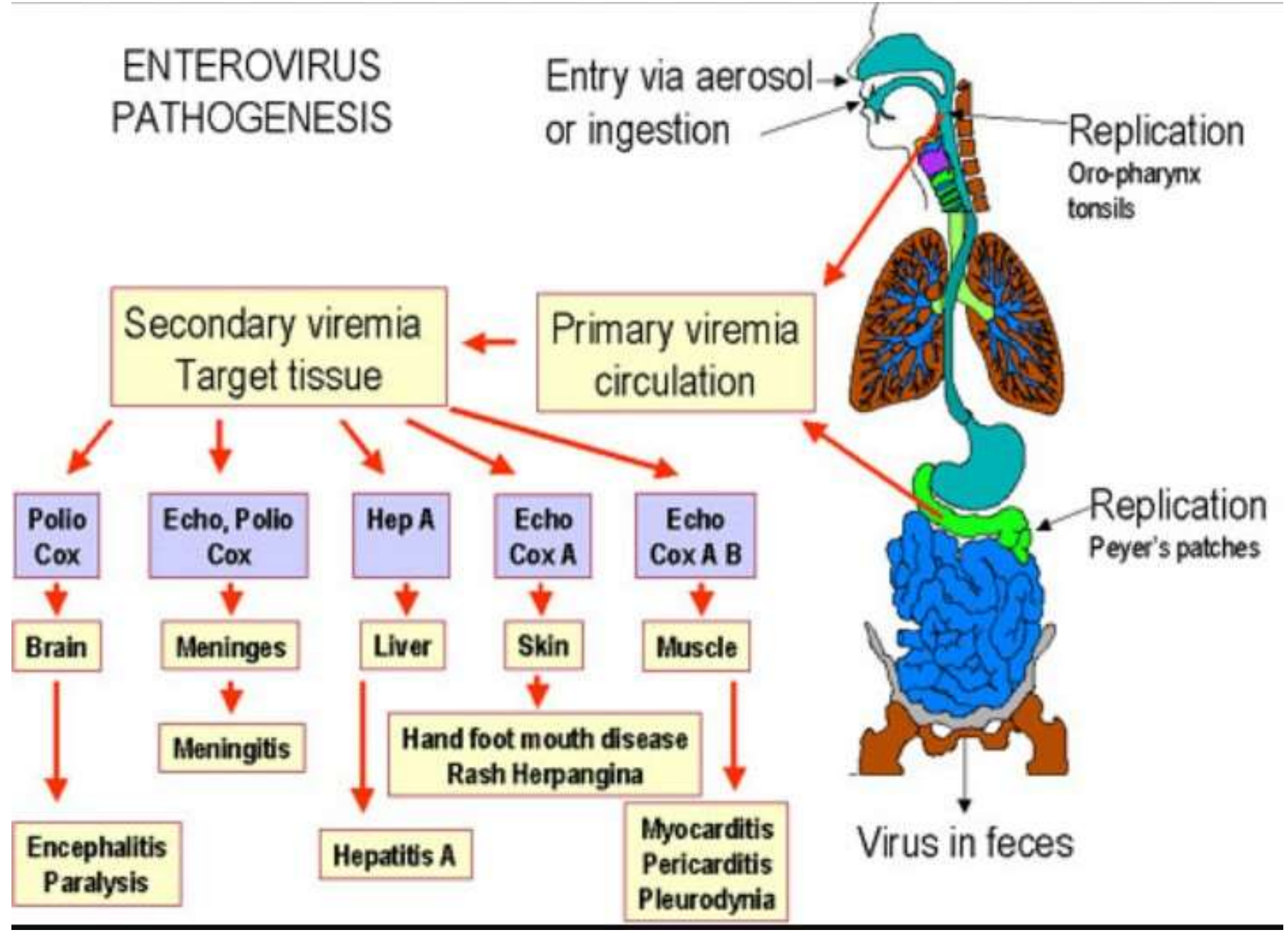

Rhino, Echo,
Coxsackie, polio
Replikasi in oropharnx
Antibodi blockage
Primary viremia blood stream
Secundary viremia
Target tissue
skin
muscle
Brain
meningen
liver
Echo, cosxsackie
Echo, cosxsackie A,B
Polio, cosxsackie
Polio, Echo, cosxsackie
Hepatitis A

Enterovirus

Pathogenesa

- Skin
  - Hand-foot-and mouth disease
  - Rash, herpangina
- Muscle
  - Heart; myocarditis, pericarditis
  - Thorax; pleuradynia
- Brain
  - Encephalitis
  - Paralytic disease
- Meningen
  - meningitis

ENTEROVIRUS PATHOGENESIS



Coxsackievirus

- ***Group A :***
- **myositis**
- ***flaccid paralysis***
- **23 serotypes**

- ***Group B :***
- **pankreatitis, miokarditis, encephalitis, hepatitis**
- ***irregular- muscle tonicity rolling disease***
- **6 serotypes**

Coxsackievirus

- *Encephalitis*
  - Echovirus dan coxsackievirus
  - 11-22% viral encephalitis (termasuk polioviruses)
  - Prognosis kecuali pada bayi : baik
- *Chronic meningoencephalitis*
  - Pasien dengan congenital defects pada sel B
  - Echoviruses dapat disembuhkan dari CSF
  - Mencegah IG

Coxsackievirus

- ***Paralytic Infections***
  - Coxsackie dan echovirus
  - **flaccid paralysis** : coxsackievirus A7 dan enterovirus 71
  - Tidak separah infeksi poliomielitis
  - Paresis tidak menetap

Coxsackievirus

Central Nervous System

- ***Aseptic meningitis***
  - Prodrome- fever, menggigil, malaise, URI, Headache, leher kaku, photophobia
  - 90% viral aseptic meningitis dimasyarakat : group B coxsackieviruses dan echoviruses
  - CSF: 10-500 WBC, lymphocytes, protein sedikit meningkat, glucose
  - PCR spinal fluid untuk mencari penyebab
  - Therapi : supportive

Coxsackievirus

Exanthems

- ***Morbilliform rashes***
  - **erythematous, maculopapular rashes**
  - Rash muncul bersamaan dng demam dan dimulai **wajah**
  - echovirus 9

Coxsackievirus

- ***Roseoliform rashes***
  - **Discrete, non pruritic, salmon-pink macules dan papules di wajah dan dadabagian atas**
  - Prodrome : demam dan pharyngitis
  - Rash muncul saat suhu tubuh menurun dan berlangsung 1-5 hari
  - Menular di kalangan anak-anak muda
  - Echovirus 16

Coxsackievirus

- ***Generalized vesicular eruptions***
  - coxsackievirus A9 dan echovirus 11
  - Lesi di kepala, badan dan extremities
  - Tidak berubah menjadi pustules atau scabies (tidak seperti chickenpox)

Coxsackievirus

- ***Herpangina***
  - **Vesicular rash** terletak **pharynx dan soft palate**
  - Outbreaks : group A coxsackievirus
  - Demam, vomiting, myalgia dan headache

Coxsackievirus

Hand, foot and mouth disease

- ***Hand-foot-and-mouth disease***
  - **vesicular eruption** penyebab coxsackie A16 atau enterovirus 71
  - Pada **anak** usia < 10 th
  - Demam dan vesicles di mulut, tangan dan kaki
  - Gambaran spt chickenpox, gejala lebih ringan

Coxsackievirus

Respiratory Disease

- ***Upper respiratory infections***
  - Fever dng sore throat, cough dan coryza
  - Pada anak-anak
  - Coxsackieviruses A21 dan A24; echovirus 11
- ***Epidemic pleurodynia***
  - Acute dengan demam,nyeri spasmodic di dada/perut bagian atas
  - Demam tinngi setelah nyeri spasmodik
  - 4-6 hari, bertahan selama berbulan-bulan

Coxsackievirus

- **Myopericarditis**
  - Inflammation of the myocardium and pericardium
  - Enteroviruses, especially group B coxsackieviruses, group A types 4 and 16 and echoviruses 9 and 22 account for 50% of all cases of acute myopericarditis
  - Virus appears to replicate in the myofibers leading to myofiber necrosis and focal inflammation

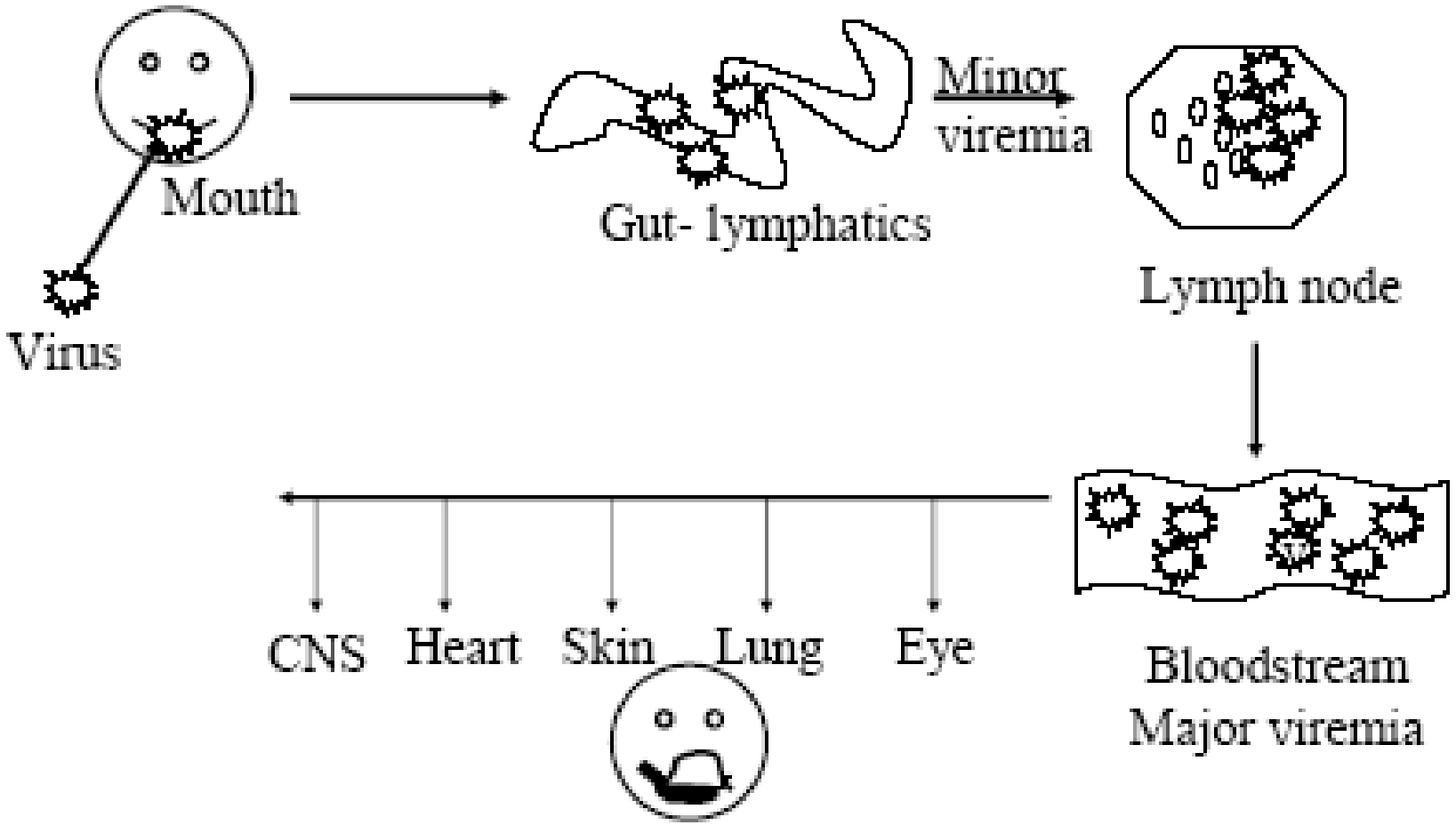
Coxsackievirus

- **Acute hemorrhagic conjunctivitis**
  - Enterovirus 70 associated
  - Epidemic outbreaks of eye pain, swelling and subconjunctival hemorrhage
  - Highly contagious
  - Usually bilateral
  - Most cases resolve spontaneously

Poliovirus

- Cause of poliomyelitis
- **Humans** only natural reservoir
- Predilection for the **central nervous system**
  - Extensive necrosis of neurons in gray matter
  - Affects primarily motor and autonomic neurons
  - Anterior horn of spinal cord
  - Motor nuclei of pons and medulla

Pathogenesis



Poliovirus

- Virus excreted in **stools** for several weeks
- Present in pharynx for 1- 2 weeks
- High percentage of asymptomatic and subclinical infections compared to clinical infections

Poliovirus Infections

- Range from inapparent illness to severe paralysis and death
- 95% of infections are asymptomatic

Poliovirus

Poliovirus Infections

- ***Abortive poliomyelitis (mild clinical)***
  - Mild viral syndrome
  - Fever, headache, sore throat, listlessness
  - Normal neurologic exam
  - Lasts a few days
- ***Nonparalytic poliomyelitis (aseptic meningitis)***
  - Like abortive polio but signs of meningeal irritation; back pain, muscle spasms
  - Full recovery

Poliovirus

- ***Spinal paralytic poliomyelitis***
  - 0.1% of cases
  - Biphasic course
    - Minor illness- like abortive polio
    - Major illness- follows 2-5 days after recovery from minor illness
  - Abrupt illness- headache, fever, vomiting, neck stiffness, muscle pain for 1-2 days
  - Weakness and flaccid paralysis
    - Variable severity
    - Sensory loss rare

Poliovirus

- ***Bulbar Paralytic Poliomyelitis***
  - Paralysis of muscles innervated by cranial nerves
  - Dysphagia, nasal speech, dyspnea
  - Cranial nerves 9 and 10 most commonly affected
  - Can involve vasomotor and respiratory centers
    - Rapid pulse
    - Hypoxia
    - Circulatory collapse

Poliovirus

- *Polioencephalitis*
  - Uncommon
  - Confusion and change in mental status
  - Most common in infants
  - Paralysis is spastic
- *Post polio syndrome*
  - Sequele of polyomyelitis (30 -40 years later)
  - Polio is not present

Poliovirus

Diagnosis

- Viral isolation from throat- first week of illness
- Isolation from stool for several weeks
- Rarely isolated from CSF
- Paired serology

Poliovirus

Prevention

- Two vaccine formulations
- **Oral Polio vaccine (OPV)**
  - Live attenuated vaccine
  - Given orally
  - Excreted in feces- allows spread of vaccine to unimmunized individuals- herd immunity
  - Very rare- paralytic disease

Poliovirus

Prevention

- **Inactivated Polio vaccine (IPV)**
  - Modified from original **Salk vaccine**
  - At least as immunogenic as OPV
  - Only vaccine used in US currently

Rhinovirus

- Most common cause of the **common cold** **(**2 – 5 colds each year)
- Cause 30% of all upper respiratory infections
- Resistant to detergents, lipid solvents and temperature extremes, sensitive pH of les than 6
- **Transmisi**
  - Direct contat via infected hands and fomites
  - Inhalation of infectious droplets

Rhinovirus

Clinical Manifestations

- Infect the nasal epithelial cells and active inflammatory mediators
- **Symptoms :**
  - a profuse watery discharge, nasal decongestion, sneezing, headache, sore throat and cough
  - Severe case : bronchitis asthma

Diagnostic

- A acidic buffer : rhinovirus are acid labil, enterovirus are acid stable

Rhinovirus

Treatment

- Supportive care
- Bronchodilators
  - Studies suggest inhaled epinephrine more efficacious than inhaled ß-agonists
  - Ribavirin
- Aerosol
- High-risk individuals only
- DO NOT GIVE ANTIBIOTICS FOR THE COMMON COLD

VIRUS RNA

RETROVIRIDAE

Retroviridae

- Subfamilies : Oncoviridae and Lentiviridae
- Oncoviridae : the human T-lymphotropic viruses (HTLV-1, HTLV-2, HTLV-5) : not cytolitic, leukemias, sarcomas and lymphomas
- Lentiviridae : HIV cause aquired immune deficiency syndrome (AIDS)
- Transmitted : blood and exchange of other body fluids
- Individuals at risk : multiple sex partners, IV drug, blood resipient, children of infected mothers, ulcerative sexually transmitted infections

Retroviridae

- The target cells are the CD4 T cells, monocytes and macrophages
- Clinical Latency, replication in lymphoid tissue
- Virus id not dectable in the bloodstream, and the patient remains asymptomatic
- The average lenghth : 10 years
- Diagnostic :
  - Anti-HIV ab, viral antigen RNA
  - Imunologic markers for AIDS

Retroviridae

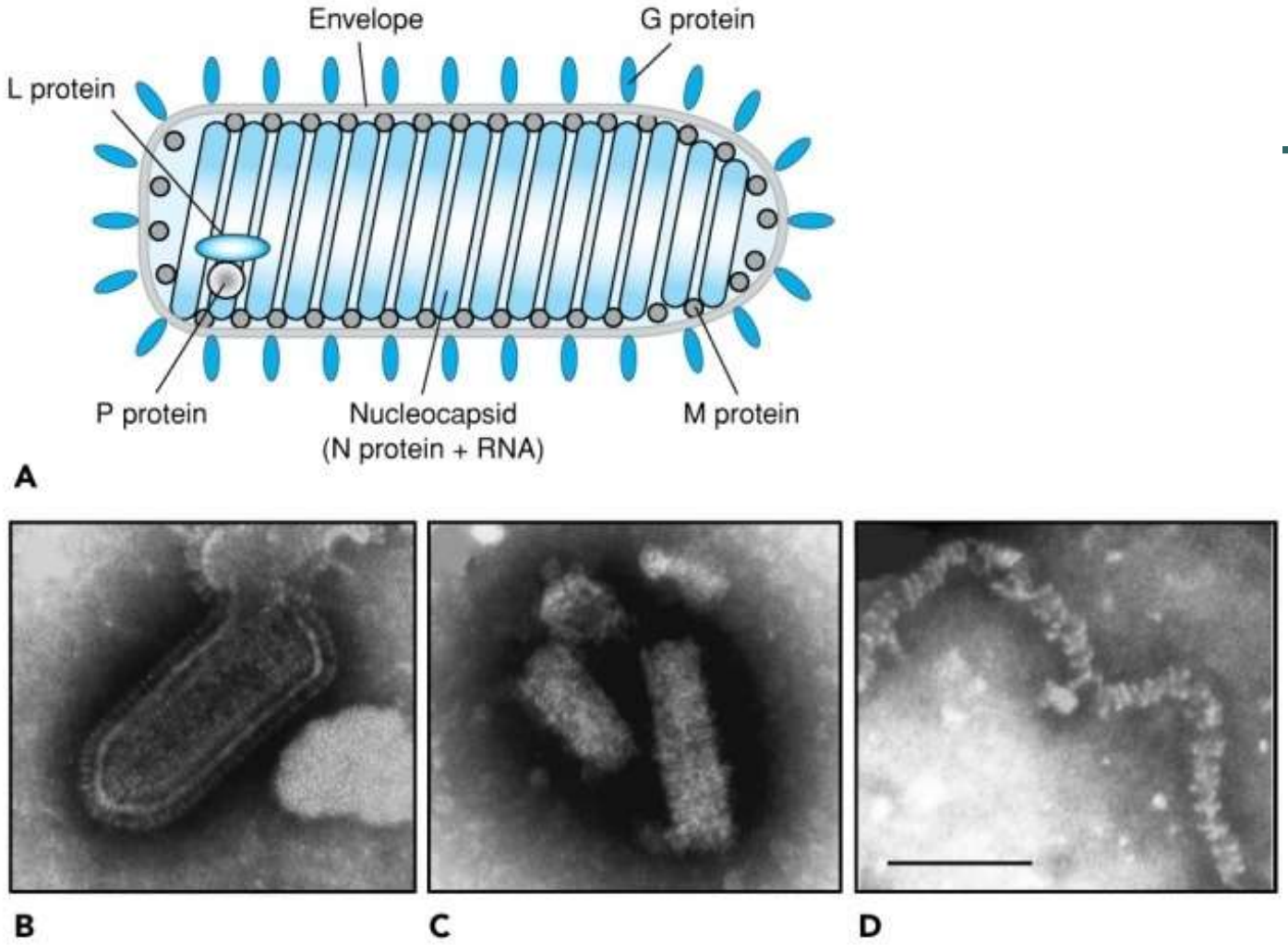
BOX 29-1 Opportunistic Infections and Cancers Commonly Seen in Patients with AIDS

- Candidiasis of the respiratory tract
- Coccidiomycosis
- Cryptococcal meningitis
- Cryptosporidiosis with persistent diarrhea
- Cytomegalovirus infections of organs other than the liver, spleen, or lymph nodes
- Histoplasmosis
- Persistent herpes simplex virus infections
- Kaposi sarcoma or lymphoma of the brain in patients younger than 60 years
- Oral hairy leukoplakia
- Lymphoid interstitial pneumonia, pulmonary lymphoid hyperplasia, or both in children younger than 13 years
- *Mycobacterium avium* complex, *Mycobacterium kansasii*, or *Pneumocystis jiroveci* pneumonia
- Progressive multifocal leukoencephalopathy
- Recurrent pneumonia
- Toxoplasmosis of the brain in infants older than 1 month
- Wasting disease

VIRUS RNA

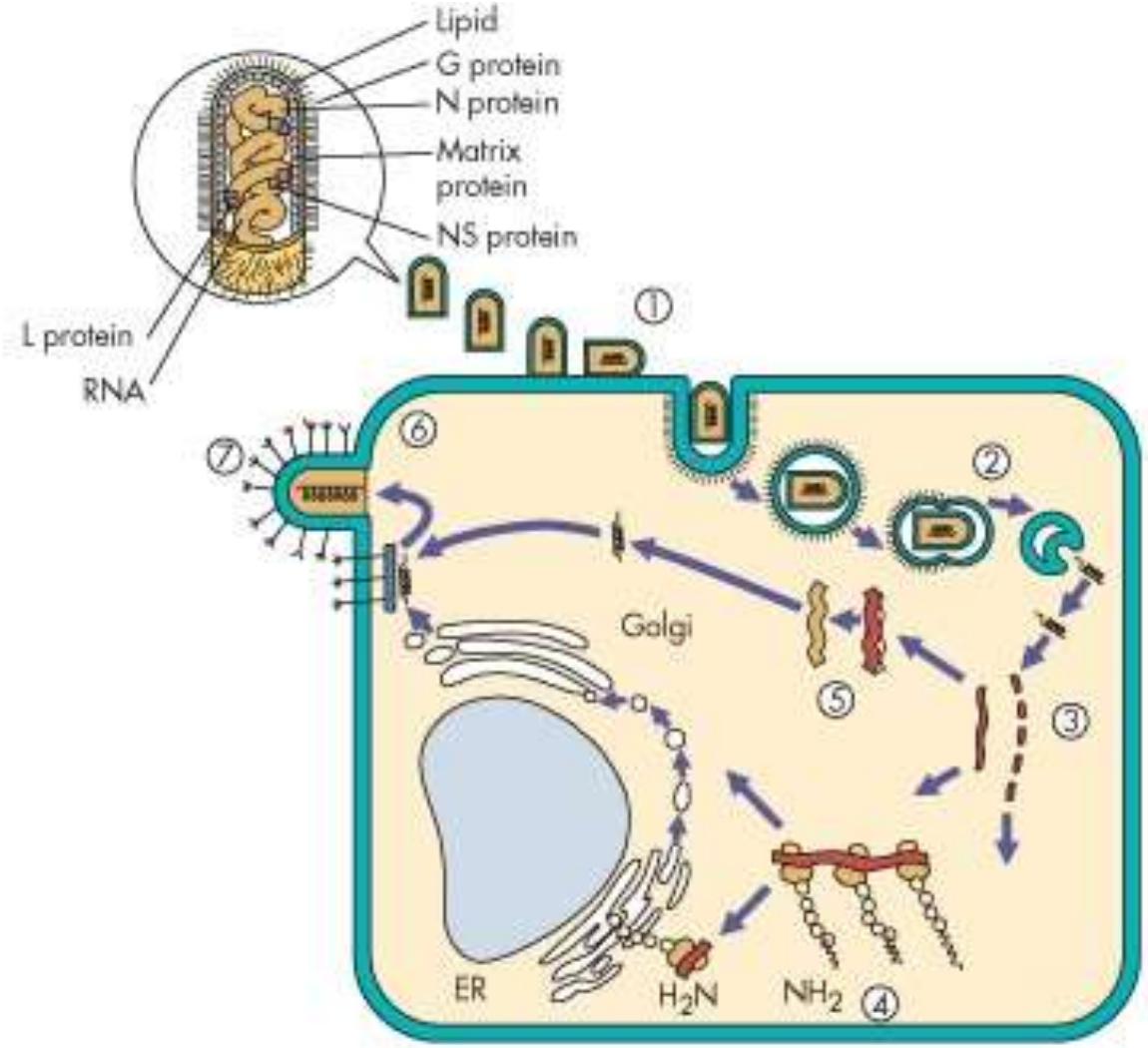
RHABDOVIRUSES

Rhabdovirus virion structure

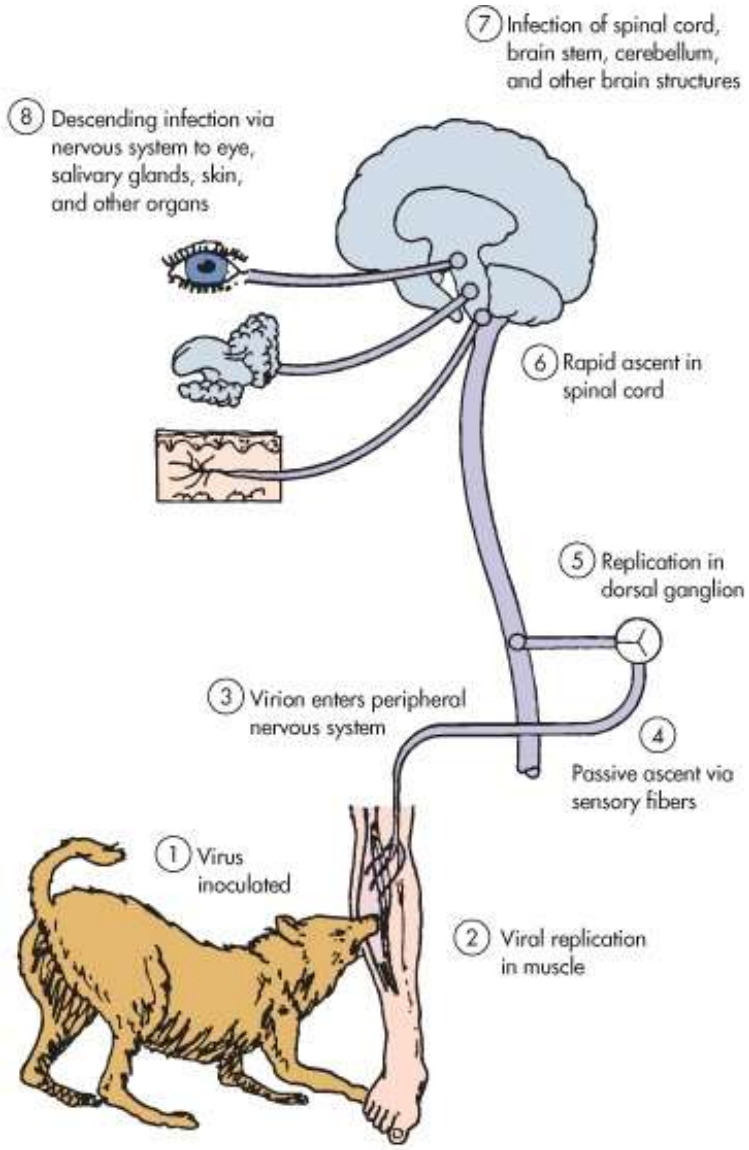


A: Diagram of rhabdovirus virion. B: Negative stain electron micrograph of vesicular stomatitis virus (VSV) virion. C: VSV nucleocapsid-M protein complexes prepared by solubilization of virion envelopes with triton X-100 in low ionic strength buffer. D: VSV nucleocapsids prepared by solubilization of virion envelopes with triton X-100 in high ionic strength buffer. Bar, 100 nm. (From Fields Vriology (2007) 5th edition, Knipe, DM & Howley, PM, eds, Wolters Kluwer/Lippincott Williams & Wilkins, Philadelphia Fig. 39.2)

Rhabdovirus replication



Rabies pathogenesis



Rabies disease time course

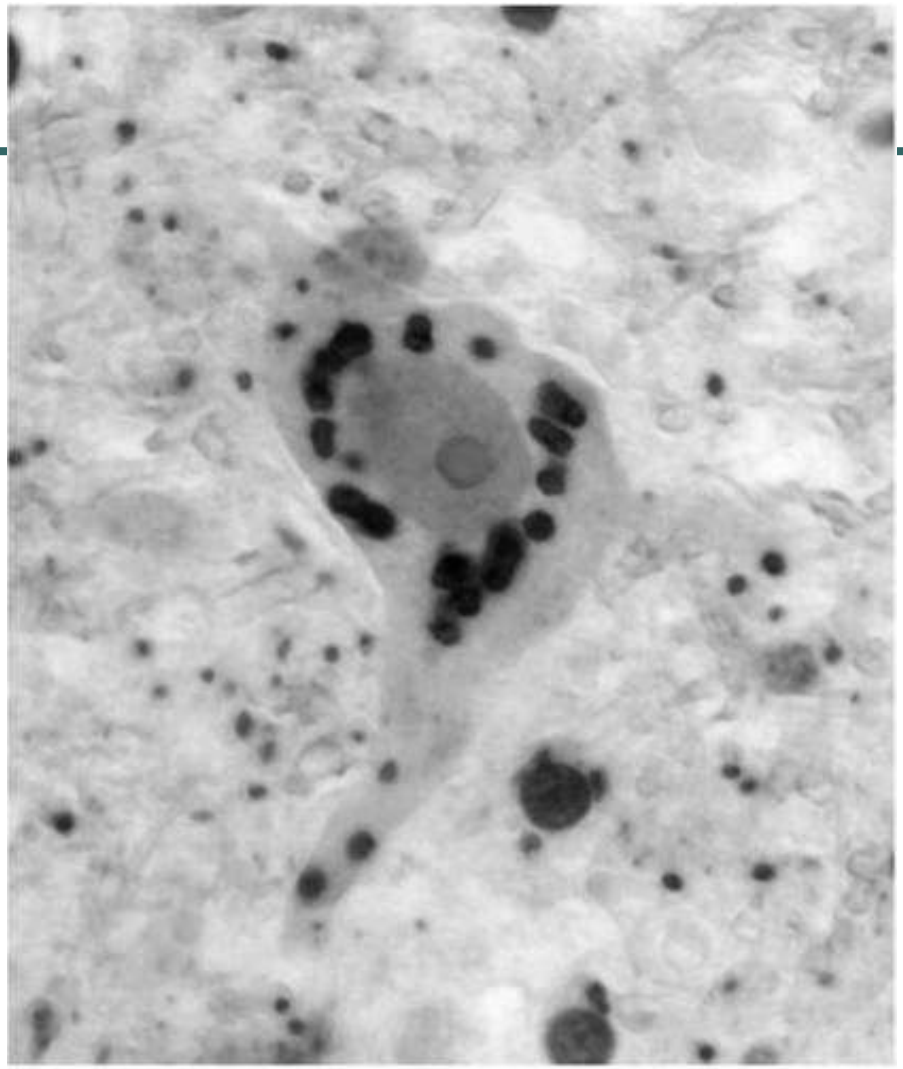
Disease Phase	Symptoms	Time (days)	Viral Status	Immunologic Status
Incubation phase	Asymptomatic	60–365 after bite	Low titer, virus in muscle	—
Prodrome phase	Fever, nausea, vomiting, loss of appetite, headache, lethargy, pain at site of bite	2–10	Low titer, virus in CNS and brain	—
Neurologic phase	Hydrophobia, pharyngeal spasms, hyperactivity, anxiety, depression CNS symptoms: loss of coordination, paralysis, confusion, delirium	2–7	High titer, virus in brain and other sites	Detectable antibody in serum and CNS
Coma	Coma: cardiac arrest, hypotension, hypoventilation, secondary infections	0–14	High titer, virus in brain and other sites	—
Death	—	—	—	—

Progression of rabies disease. (From Medical Microbiology, 5th ed., Murray, Rosenthal & Pfaller, Mosby Inc., 2005, Table 61-1.)

Rabies treatment

- Wash wound with soap
- Inject human antirabies IgG into wound
- Vaccination on days 0, 3, 7, 28 post exposure
- Determine if animal is rabid

Negri bodies



Immunohistochemical staining of intra-cytoplasmic viral inclusions in the neuron of a human rabies patient. (Fields Vriology (2007) 5th edition, Knipe, DM & Howley, PM, eds, Wolters Kluwer/Lippincott Williams & Wilkins, Philadelphia Fig. 39.9)

Rabies summary

- Structure
  - Negative sense ssRNA, helical nucleocapsid, envelope
- Pathogenesis
  - Transmitted by bite of rabid animal
  - Replication in cytoplasm; budding
  - Spread by axonal transport to brain; long incubation period
  - Fever, nausea, hydrophobia, coma
  - Almost always fatal
- Diagnosis
  - Viral antigen or nucleic acid, Negri bodies
- Treatment/prevention
  - Inactivated viral vaccine for humans after exposure, live virus vaccine for animals

VIRUS RNA

ARBOVIRUS

Virus Group	Human Phatogens
Togaviruses	
Alphavirus	Arboviruses
Rubivirus	Rubellavirus
Pestivirus	None
Arterivirus	None
Flaviviruses	Arboviruses
	Hepatitis C virus

Togavirus & Flavivirus

Structure

- Icosahedral, envelope
- Single-stranded, positive sense RNA viruses
- Transmitted by **arthropods vector**
- Replicate in the cytoplasma
- Broad host range, including vertebrates (e.g mamals, brids, amphibians, reptils) and invertebrates (e.g mosquitoes, ticks)

Viruses	Vector	Host	Disease
Alphaviruses			
Chikungunya	Aedes	Humans, monkeys	Fever, arthralgia, arthritis
Western equine encephalitis	Culex, Culiseta	Birds	Milds systemic; encephalitis
Eastern equine encephalitis	Aedes, Culiseta	Birds	Milds systemic; encephalitis

Viruses	Vector	Host	Disease
Flaviviruses			
Dengue	Aedes	Humans, monkeys	Mild systemic; break-bone fever, dengue hemorragic fever, and shock syndrome
Yellow fever	Aedes	Humans, monkeys	Hepatitis, hemorrhagic fever
Japanese encephalitis	Culex	Pigs, birds	Encephalitis

Phatogenesis

- Blood meal from a viremic vertebrata host
- Virus then infects the epithelial cells of the midgut of mosquito, spreads through the basal lamina of the midgut to the circulation, and infects the salivary glands (except : *Culex tarsalis* mosquito)
- Host; virus-containing saliva into the victim's bloodstream → circulates in the host's plasma → target cells

Epidemiology

Disease/viral factors

- Enveloped virus must stay wet and can be inactived by drying, soap, and detergent
- Virus can infect mammals, birds, reptiles, and insects
- Asymtomatic or nonspesific (flulike fever or chills), encephalitis, hemorrhagic fever or arthritis

Clinincal syndrome

Alphavirus disease

- low-grade disease
- Influenza-like symptoms (chills, fever, rash, aches)
- EEE, WEE can progress to encephalitis, (EEE severe disease)
- *Chikungunya* refers to the crippling arthritis

Clinincal syndrome

Flavivirus disease

- Serious encephalitis or hemorrhagic disease
- The hemorragic viruses are dengue and yellow fever viruses
- Dengue fever is also known as *break-bone fever*, with symptoms and signs; high fever, headache, rash, and back and bone pain (6 – 7 days)

Clinincal syndrome

Flavivirus disease

- Yellow fever infections are characterized by severe systemic disease, with degeneration of the liver, kidney, and heart and hemorrhage.
- Joundice, massive gastrointestinal hemorragies (“black vomit”)
- Mortality rate > 50%

Laboratory diagnosis

- Difficult to isolate
- Cytophatological
- Immunofluorescence
- Hemadsorption of avian erythrocite
- Hemagglutination inhibition
- Enzyme-linked immunosorbent assays
- Latex agglutination

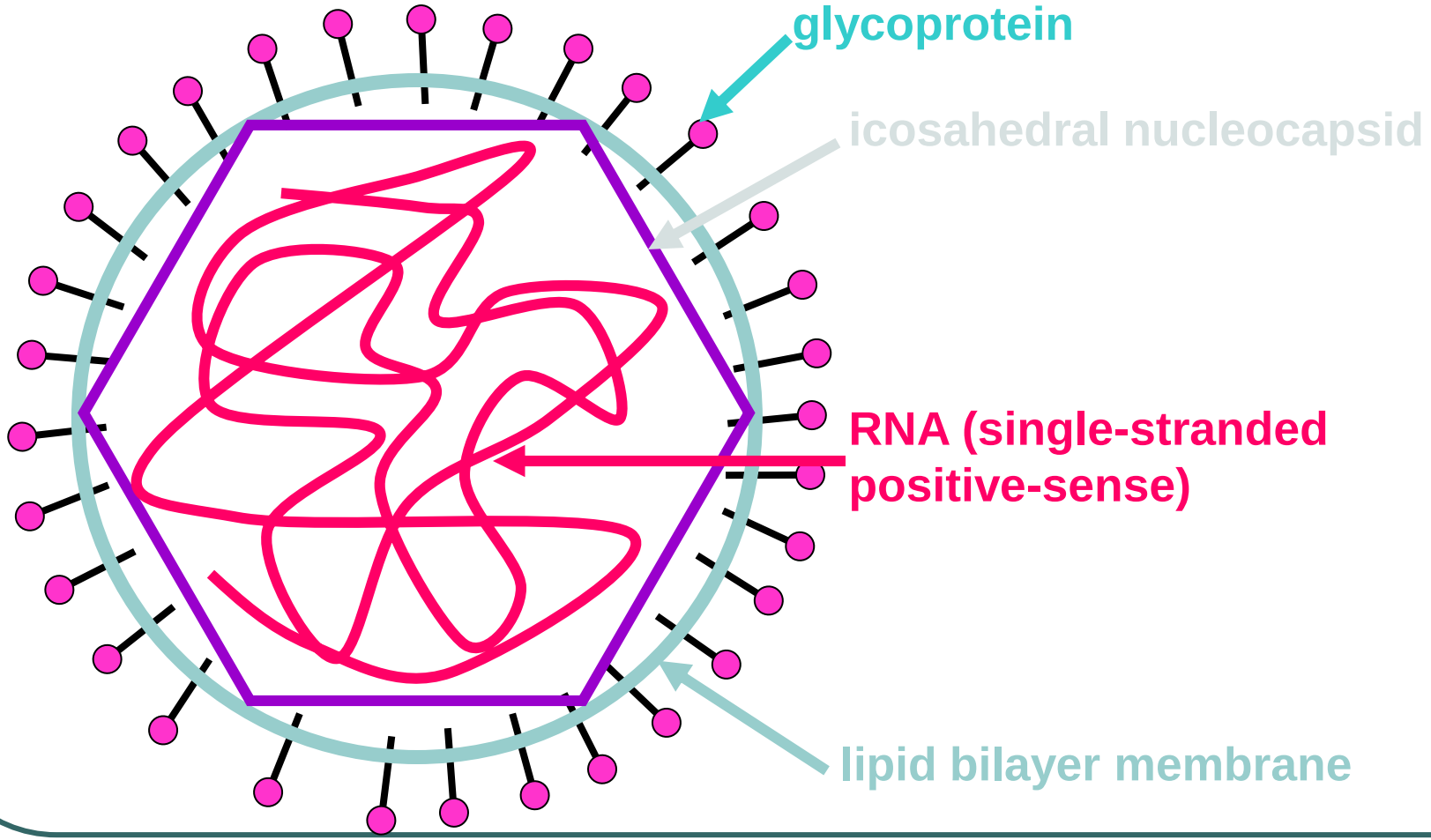
Treatment, prevention and control

- No treatment
- Supportive care
- Prevent; elimination vector and breeding-grounds
- Vaccine

VIRUS RNA

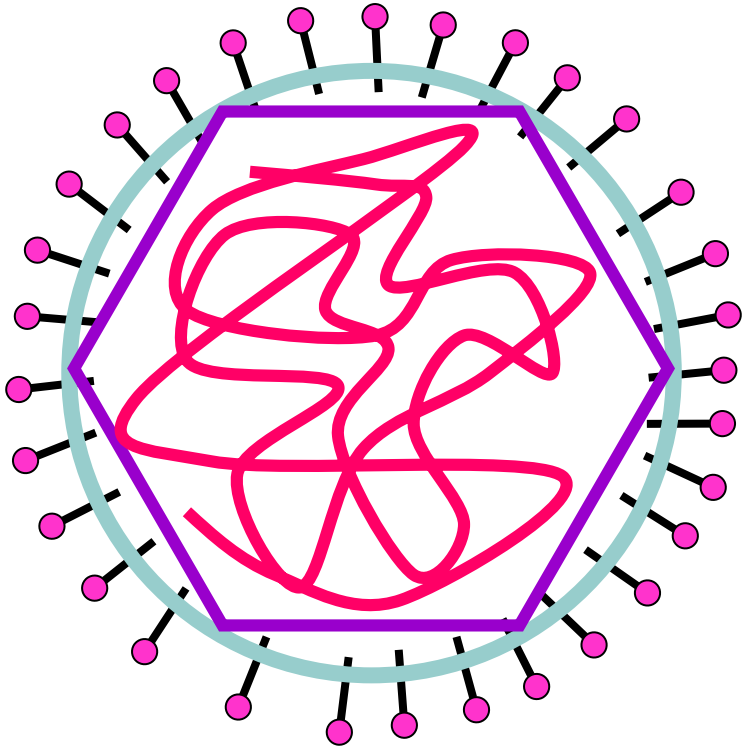
RUBELLA VIRUS

Rubella virus (German measles)

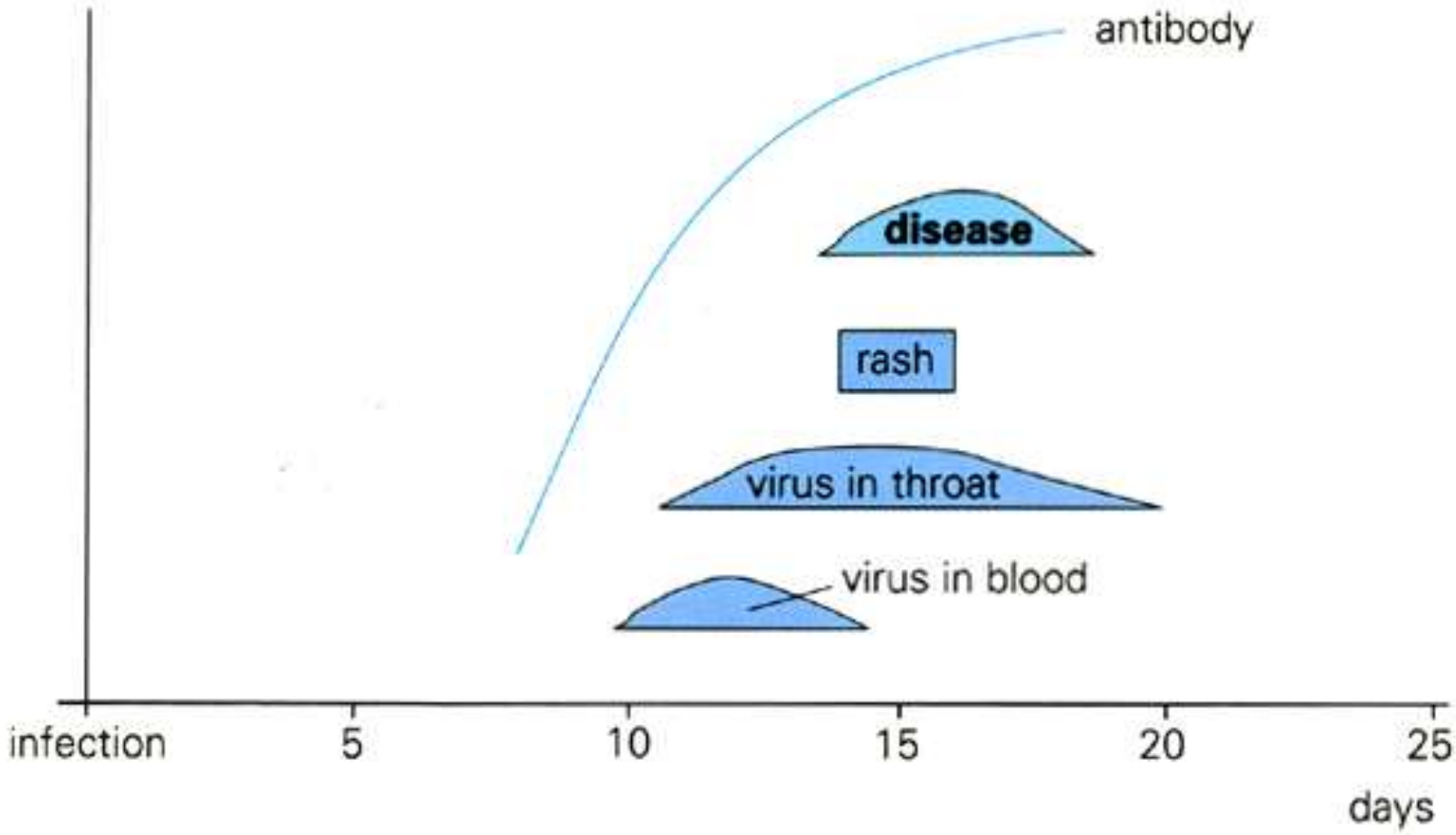


Rubella virus

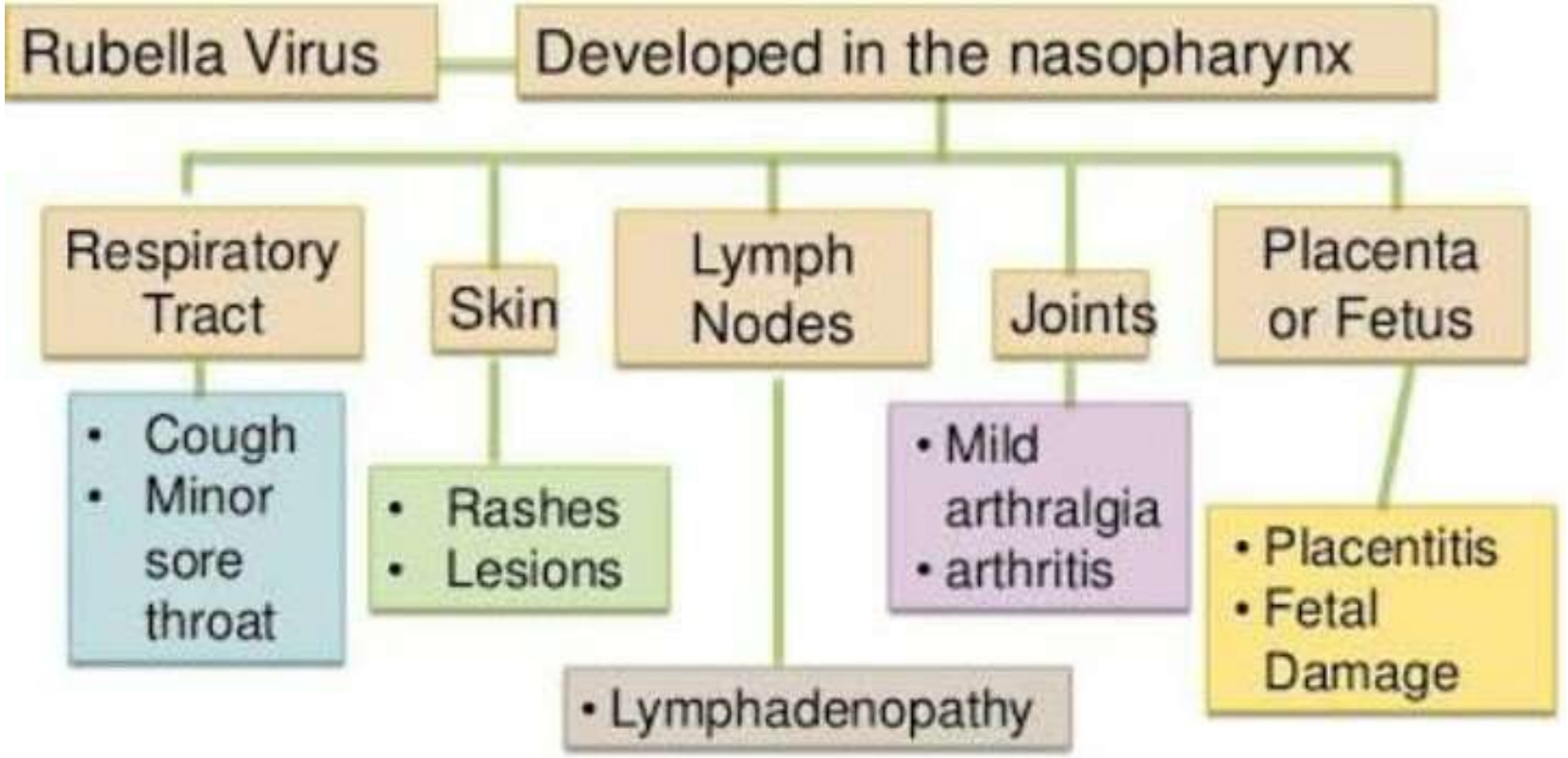
- Togavirus family
  - Alphavirus genus
  - Rubivirus genus
- Aerosol
- Children, Adults
  - mild
- Fetus
  - can be severe



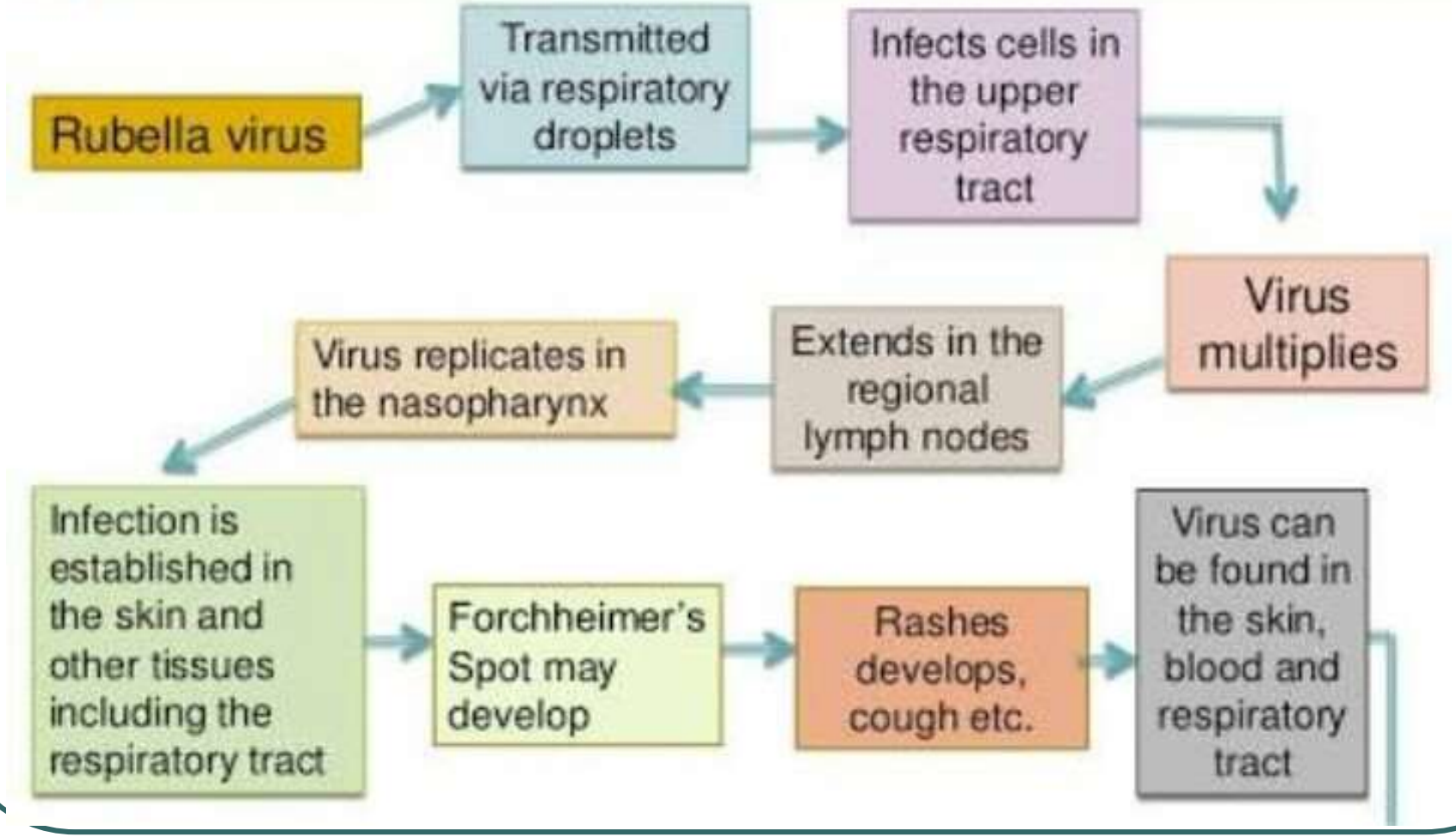
THE PATHOGENESIS OF RUBELLA



PATHOGENESIS



PATHOPHYSIOLOGY



Epidemiology

- Rubella infects only humans
- Virus causes asymptomatic disease
- There is one serotype
- Man sole host
- World wide
- Natural infection protects for life
- Transmission; respiratory route

Symptoms; children and adults

- Sore throat, runny nose, cough
- fever
- Rash, minor, irregular
  - lasts 12hour to 5days
  - not always seen
- Arthralgia, arthritis
  - especially in adults, especially women
- Lymphoadenopathy

Complications, protection

- Encephalitis (rare)
- IgG, IgA
- IgM may persist

Effects on fetus

- Hearing loss
- Congenital heart defects
- Neurological
  - Pyschomotor and/or mental retardation
- Microcephaly
- Ophthalmic
  - Cataract, glaucoma, retinopathy

Effects on fetus

- thrombocytopenia
- hepatomegaly
- splenomegaly
- intrauterine growth retardation
- bone lesions
- Pneumonitis
- First trimester
  - 65-85% of neonates have sequelae

Congenital infections

- Shed virus for a year or more after birth
  - nasopharynx, urine, feces
- Eye problems
- Glandular complications
  - diabetes
  - thyroid problems
  - deficiency growth hormone
- Progressive rubella panencephalitis

Diagnosis

- Serology
  - Significant rise in IgG
  - Positive for IgM
- Isolation
- ~50% infections sub-clinical
- rash not always seen
- many other agents cause similar symptoms

Treatment, prevention

- No treatment
- Live attenuated vaccine (Measles, Mumps, Rubella vaccine/MMR)
  - does not spread to family members
  - children
  - susceptible non-pregant females

Wassalam