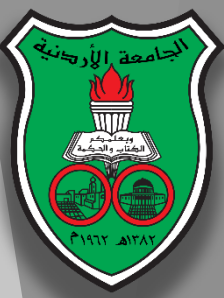


*Medical Virology for MD students*



# *Paramyxoviridae & Togaviridae*

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Examples :

Parainfluenza/ syncytial virus **Paramyxoviridae**

❖ The paramyxoviruses include the most important agents of **respiratory infections** of **infants and young children**, as well as the causative agents of two of the common contagious diseases of childhood (**mumps** and **measles**). **الحصبة** **النكاف**

❖ All members of the *Paramyxoviridae* family **initiate** infection **via the respiratory tract**.

❖ The paramyxoviruses are enveloped **-ss RNA viruses** with non-segmented genome.

**Orthomyxovirus** : segmented / **paramyxovirus** : non segmented

Respiratory syncytial virus is the the most serious virus of these respiratory viruses in infants but it can be treated so it's important to seek for medical attention + to isolate the infant to prevent the spread

**Acute respiratory infections and pneumonia are responsible for the deaths of 4 million children younger than 5 years of age worldwide.**

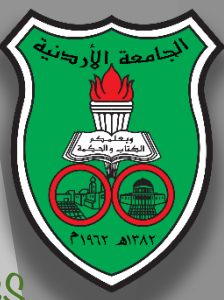
# Togaviridae

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❖ The togaviruses are **enveloped** +ss RNA viruses that contribute significantly to human disease.

❖ *Togaviridae* is divided into two genera:  
**Alphavirus** and **Rubivirus**. Rubella ( German measles )  
One kind of arboviruses ( transmitted by arthropod vectors )



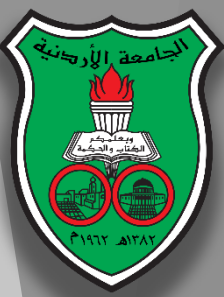


# Alphavirus

Other members of the flaviviridae family are arthropod borne viruses : e.g : yellow fever , Zika , dengue viruses

- The alphaviruses are **arthropod-borne** viruses (**arbo**viruses), which are transmitted to humans and domestic animals by **mosquitoes**.
- **The majority of infections are subclinical**, however, several clinical syndromes are associated with alphavirus infections of humans. These include:  
**acute encephalitis** (equine encephalitis viruses);  
**acute arthropathy** (**Chikungunya virus**) and a febrile illness with a **flulike syndrome**.





# Rubella virus

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- Rubella (German measles; 3-day measles) is an acute febrile illness characterized by a rash and lymphadenopathy that affects children and young adults. + fever

*In comparison to hard measles : less severe , less duration , less complications , lower mortality rate*

- **In 20–50% of cases, the primary infection is subclinical.** It is the mildest of common viral exanthems. *Viral infections that cause both rash and fever* However, infection during early pregnancy may result in **serious abnormalities** of the fetus including congenital malformations and mental retardation.
- The consequences of rubella in utero are referred to as the **congenital rubella syndrome**.

# Rubella (German Measles)

- Rubella usually begins with malaise, low-grade fever, and a **morbilliform** <sup>Flat, 1 cm in diameter skin lesions</sup> **(red macules) rash** appearing on the same day. The rash starts on the face, extends over the trunk and extremities, **and rarely lasts more than 3 days**. No feature of the rash is pathognomonic for rubella.

In children, rubella infections are self-limited, resolve completely, with almost none to few problems and gives them life-long immunity.



Anti-vaccination campaigns led to several outbreaks of measles and German measles during the past few years (some wrong scientifically incorrect articles linked vaccination to autism development).

- Unless an epidemic occurs, the disease is difficult to diagnose clinically because the rash caused by other viruses (e.g. enteroviruses, coxsackievirus, echovirus) is similar.



# Rubella (German Measles)

- Transient *Joints pain* arthralgia and *Joints infection* arthritis are commonly seen in adults, especially women.
- Rubella antibodies appear in the serum of patients as the rash fades.
- One attack of the disease confers **lifelong immunity** because only one antigenic type of the virus exists.
- **A rubella vaccine is available.**

Part of the MMR vaccine : measles  
mumps rubella

Two doses must be given

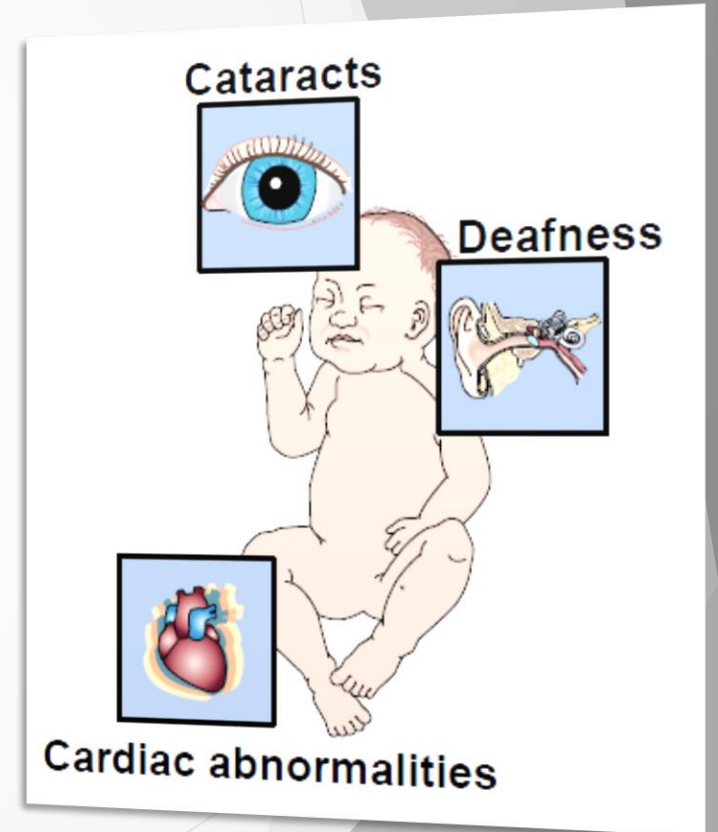
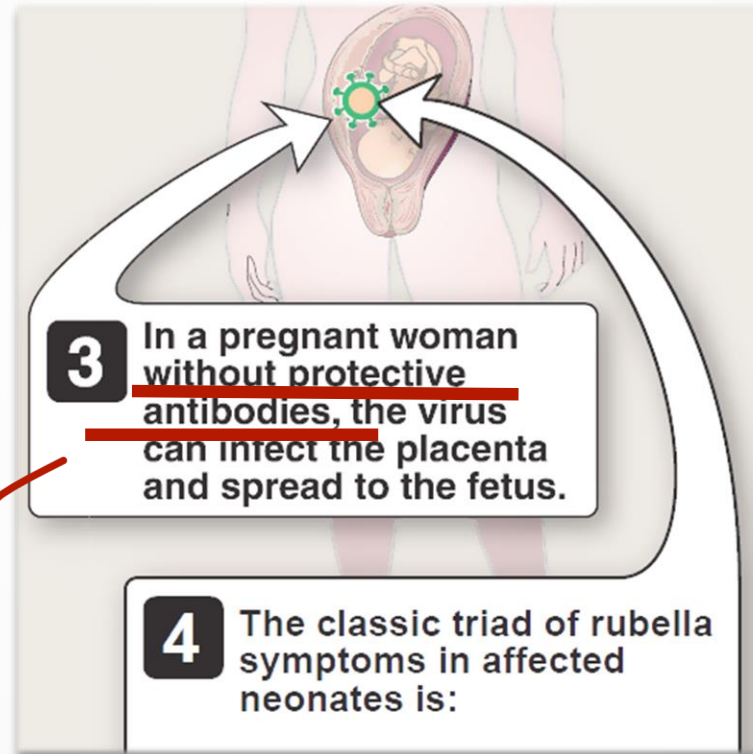
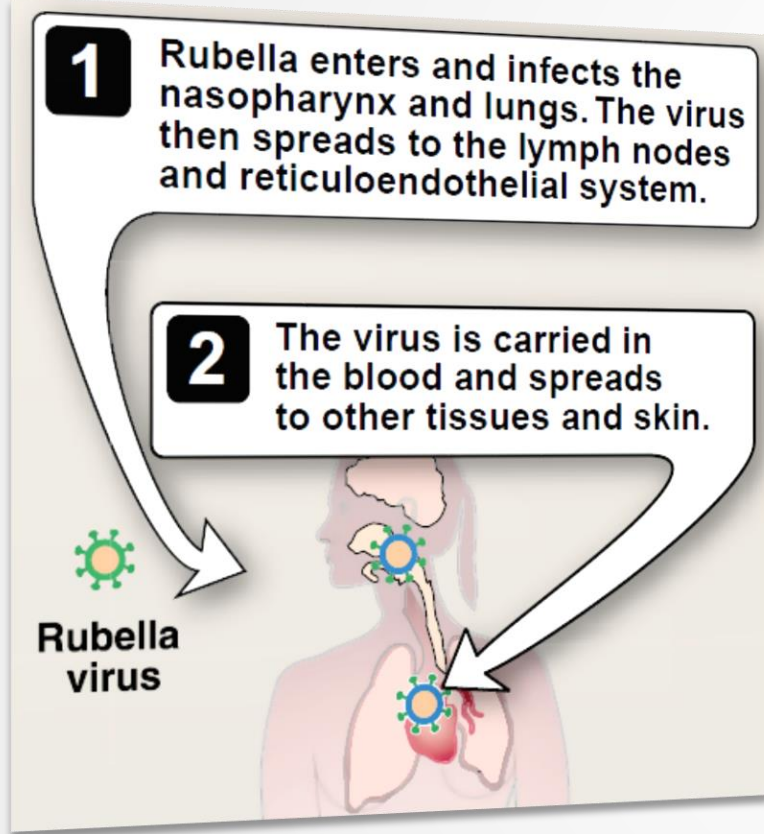
It's a live attenuated vaccine ( the most efficient type of vaccines )

Can't be given to immunocompromised

individuals nor pregnant women

Because it resembles the live fully active virus a lot , replicates , and mounts both humoral & cell mediated immune responses

# Congenital rubella syndrome

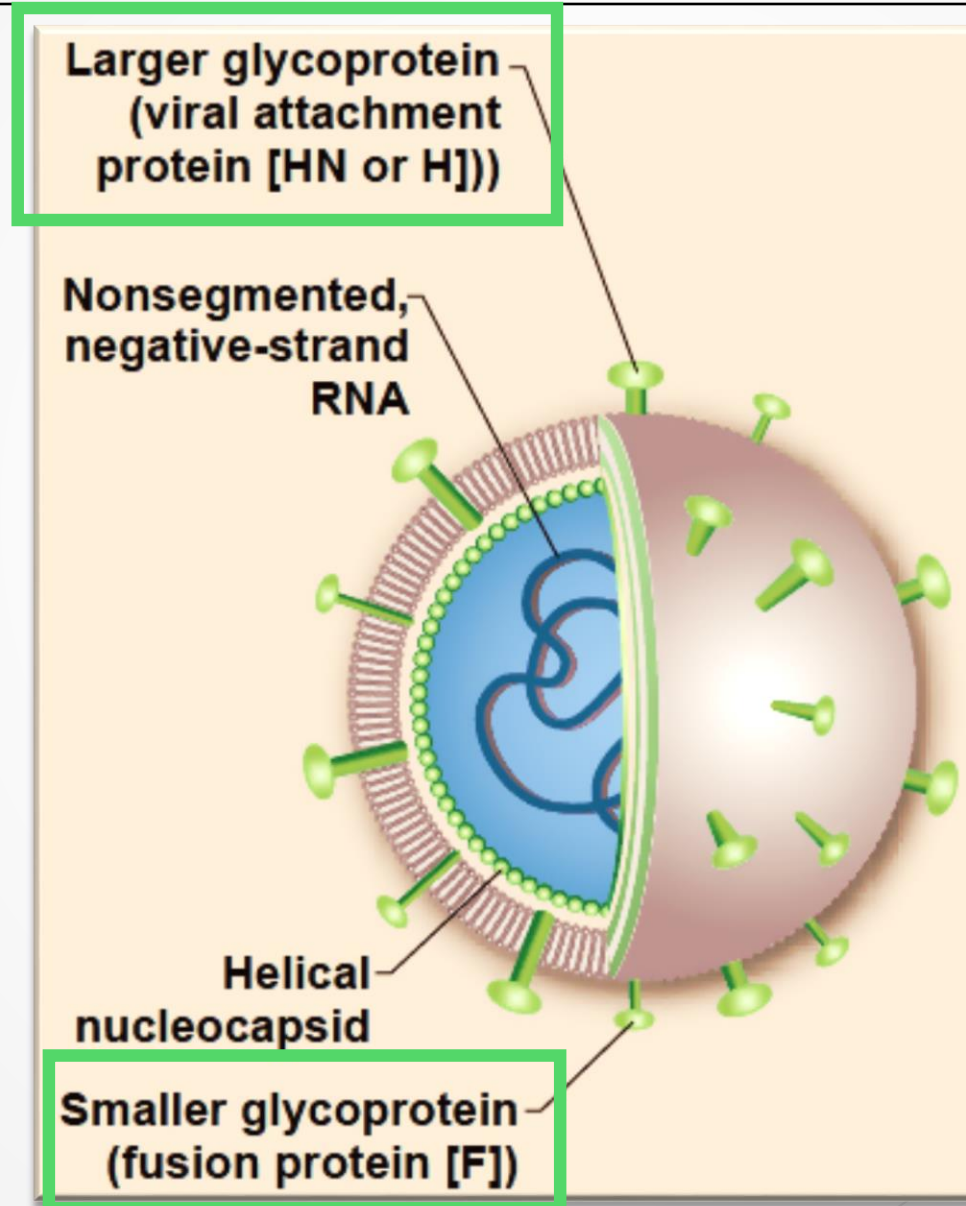


Wasn't infected before and didn't take the vaccine



# Paramyxoviridae

Non segmented ssRNA :  
no genetic reassortment



Hendra , Nipah : animal  
reservoir( bat ) / novel infections  
Hendra : respiratory infection / low  
mortality rate / origin : Australia  
( people who dealt with horses ) /  
limited / one outbreak  
Nipah : encephalitis/ high mortality  
rate ( ~ 50% ) / origin : Malaysia  
( people who dealt with pigs /  
reached other countries ( not  
limited ) / multiple consequent  
outbreaks

# Classification of *Paramyxoviridae*



<i>Subfamily</i>	<i>Paramyxovirinae</i>				<i>Pneumovirinae</i>	
<i>Genus</i>	Respirovirus	Rubulavirus	Morbillivirus	Henipavirus	Pneumovirus	Metapneumovirus
<i>Species</i>	PIV-1, PIV-3	Mumps, PIV-2, PIV-4	Measles	Hendra, Nipah	RSV	Metapneumovirus

Parainfluenza 1, 3, 2, 4

Respiratory  
Syncytial  
Virus

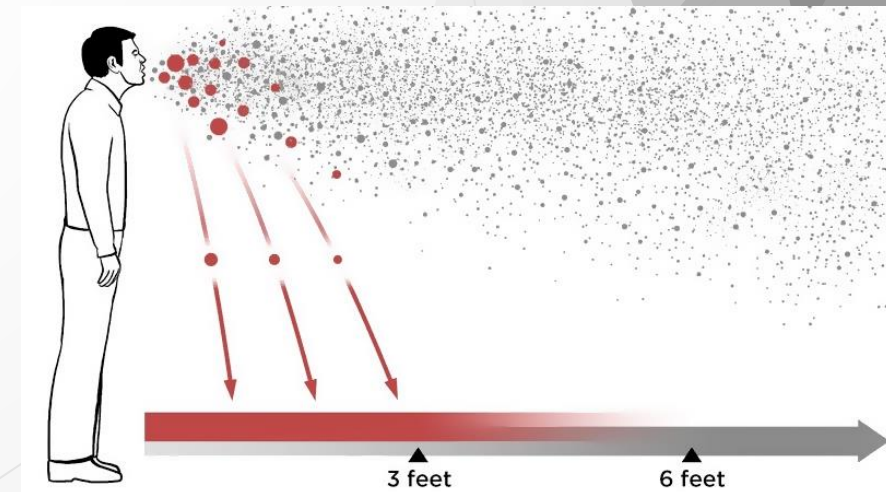
# Measles virus

Remember the complement system

- The cellular receptor for measles virus is **CD46**.
- Measles virus is transmitted by sneeze- or cough-produced **respiratory droplets**.  
Similar to chickenpox ( almost all cases are symptomatic)
- The virus is **extremely infectious**, and almost all infected individuals develop a clinical illness.
- Measles virus replicates initially in the respiratory epithelium and then in various lymphoid organs.

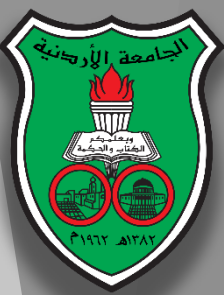
Droplets : can travel kind distances

Aerosols : travel relatively strong distances

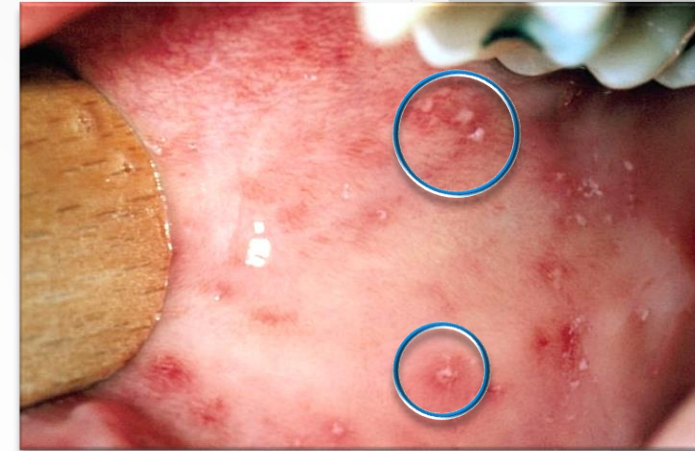


Remember: parvo ( fifth disease ) / sixth disease : rosella

# Measles (Rubeola, First Disease)



- Measles begins with a prodrome of fever, upper respiratory tract symptoms, and conjunctivitis.
- A few days later, specific signs develop; first, **Koplik spots** (small white spots on bright red mucous membranes of the mouth and throat) and then a **generalized macular rash**, beginning at the head and traveling slowly to the lower extremities.





# Measles (Hard Measles, 10-day measles)

*In some Cases measles may lead to Subacute sclerosing panencephalitis*

- Soon after the rash appears, the patient is no longer infectious.
- The major morbidity and mortality caused by measles are associated with various complications of infection, especially

**pneumonia** and **encephalitis**.

*Whoever gets infected with measles deals with*

*5% : Viral pneumonia/ secondary bacterial pneumonia*

*abnormalities in the brain electrolytes*

- The most important of these is **postinfectious encephalomyelitis**, which is estimated to affect 1 of 1,000 cases of measles, usually occurring within two weeks after the onset of the rash. This is an **autoimmune disease** associated with an immune response to **myelin basic protein**.

*30 % out of the cases die the ones who live deal with neurological changes*

*Symptoms : seizures , coma*



# Measles Dx and Prevention

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- In most cases, diagnosis can be achieved **clinically**, especially in an epidemic situation.
- The presence of **Koplik spots** provides a definitive diagnosis.
- Measles is usually a disease of childhood, and is followed by life-long immunity (single serotype).
- A live attenuated measles vaccine is available. **MMR**



# Mumps virus

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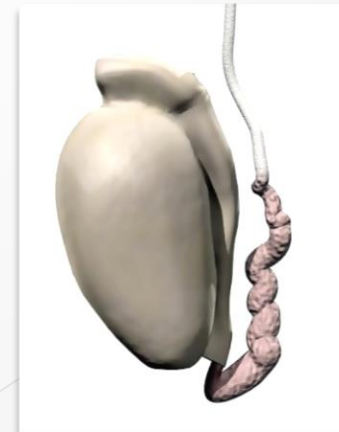
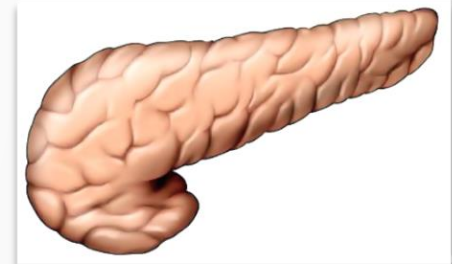
- Mumps is an acute contagious disease characterized by enlargement of one or both salivary glands.
- Mumps virus mostly causes a mild childhood disease, but in adults complications including meningitis and **orchitis** are fairly common.  
*Testicular infection*
- More than one-third of all mumps infections are **asymptomatic**.

German measles : 20-50% sub clinical

Almost all measles cases are symptomatic

# Mumps

- The virus is spread by **respiratory droplets**.  
The classic clinical presentation and diagnosis revolve around infection and swelling of the salivary glands, primarily the parotid glands.
- However, infection is widespread in the body and may involve not only the salivary glands but also the **pancreas, CNS, and testes**.  
**Orchitis** (inflammation of the testis) caused by mumps virus may cause **sterility**. العقم





# Mumps

- The diagnosis of typical cases usually can be made on the basis of **clinical** findings.
- Immunity is permanent after a single infection.
- An effective attenuated live-virus vaccine is available.
- Mumps vaccine is available in combination with measles and rubella (**MMR**) live-virus vaccines. **Two doses of MMR vaccine are recommended** for school entry.

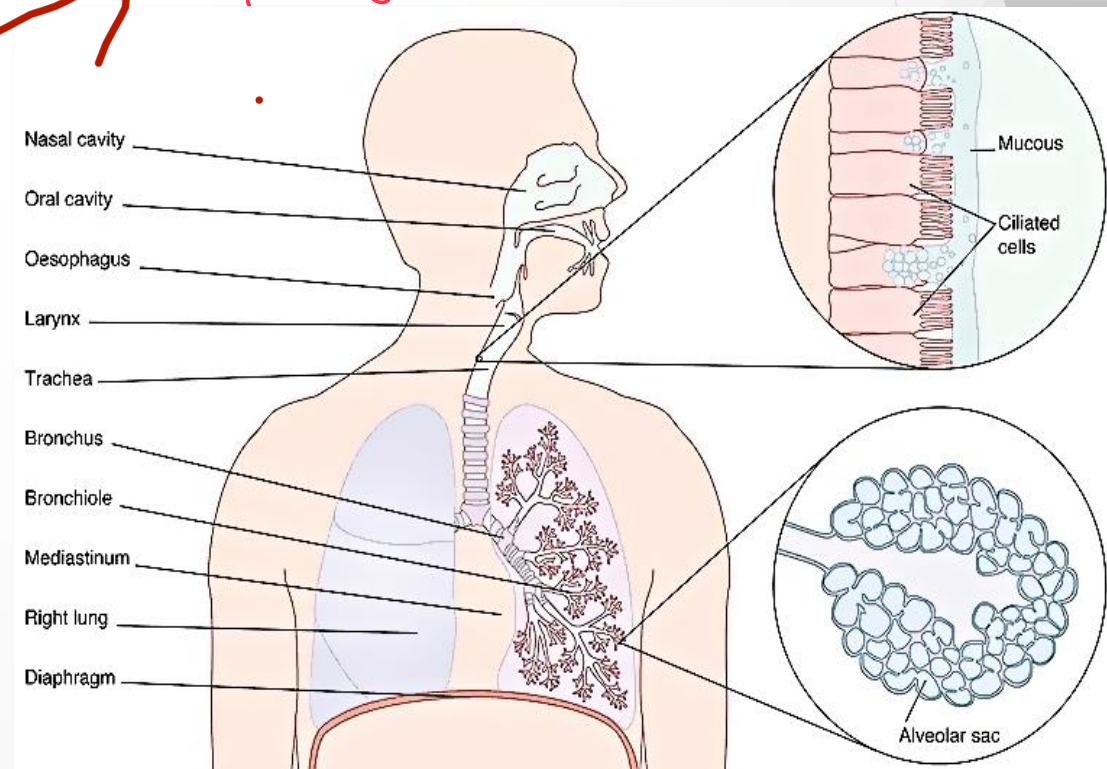
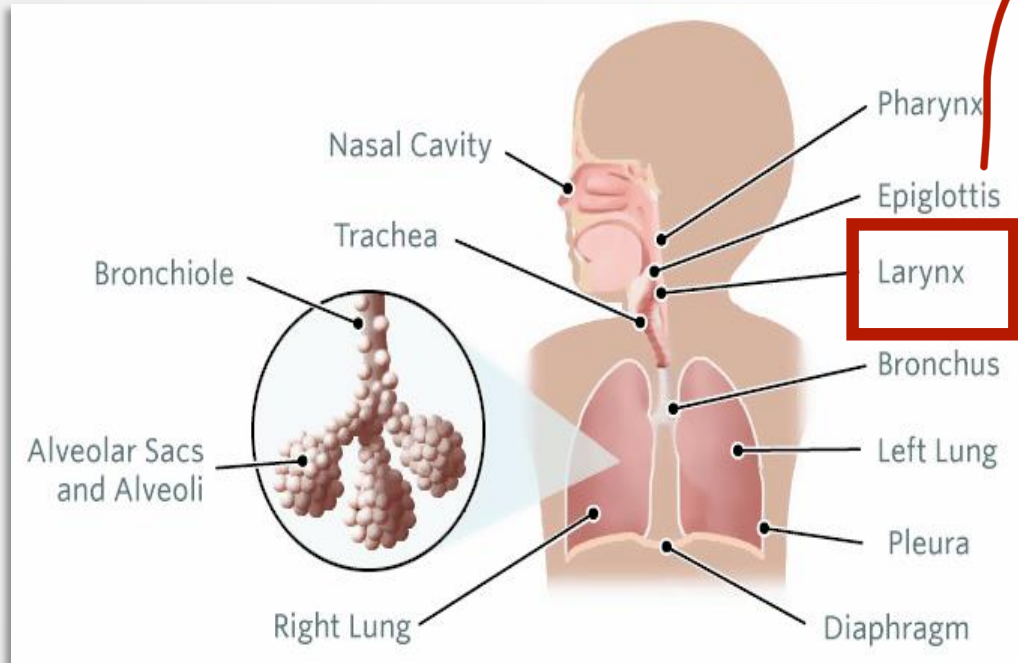


# Parainfluenza viruses (PIVs 1-4)

*Found everywhere*

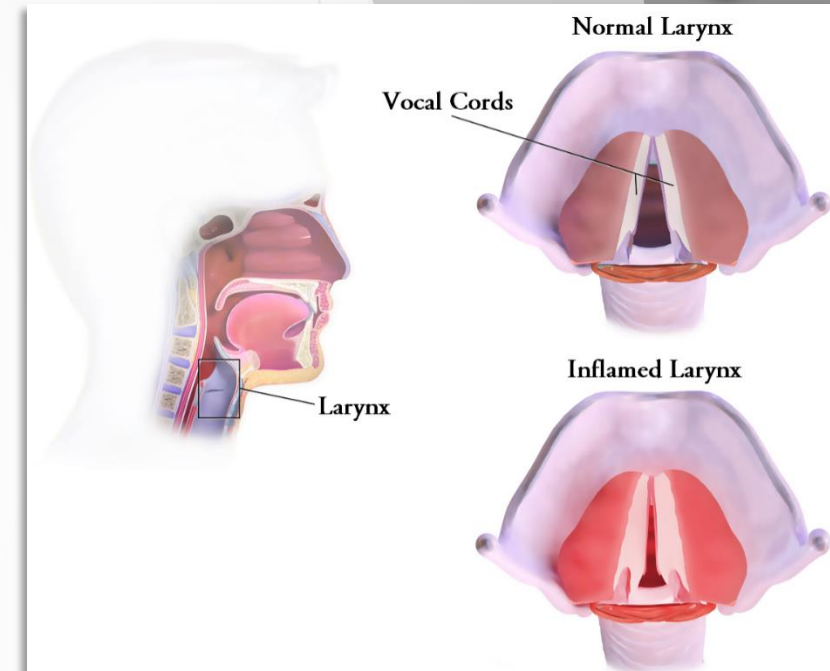
Parainfluenza viruses are ubiquitous and cause common respiratory illnesses in persons of all ages. They are major pathogens of **severe** respiratory tract disease **in infants and young children**.

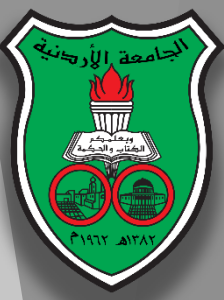
*Especially affected*



# Parainfluenza viruses (PIVs 1-4)

- Parainfluenza virus replication in the immunocompetent host appears to be **limited to respiratory epithelia**.
- The infection may involve only the nose and throat, resulting in a harmless “**common cold**” syndrome.
- Infection may be more extensive and, especially with types 1 and 2, may involve the larynx and upper trachea, resulting in **croup** (**laryngotracheobronchitis**).





# Parainfluenza viruses (PIVs 1-4)

- ❖ Factors that determine the severity of PIVs disease are unclear but include **both viral and host properties**, such as immune status of the patient, and airway hyperreactivity.

Important

- ❖ Primary infection usually results in **rhinitis** and **pharyngitis**, often with **fever**. However, primary infections caused by PIV type 1, 2, or 3 can be serious ranging from **croup** (particularly with types 1 and 2) to **bronchiolitis** and **pneumonia** (particularly with type 3).

Notice the involvement of the lower respiratory tract

- ❖ **PIV type 4 does not cause serious disease.**

- ❖ The most common complication of PIVs infection is **otitis media**.  
Ear infection

# Respiratory Syncytial Virus (RSV)



+ most common

- **RSV is the most important cause of lower respiratory tract illness in infants** and young children, usually outranking all other microbial pathogens as the cause of bronchiolitis and pneumonia in infants.
- Although the airways of very young infants are narrow and more readily obstructed by inflammation and edema, only a subset of young babies develops severe RSV disease.
- It has been reported that susceptibility to **bronchiolitis** is genetically linked to polymorphisms in innate immunity genes.

# Respiratory Syncytial Virus (RSV)

*Can cause mortality especially in infants*

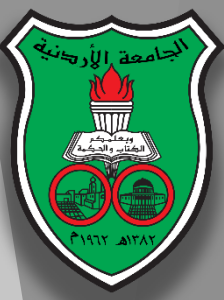
- Children who have had RSV bronchiolitis and pneumonia as infants often exhibit recurrent episodes of wheezing illness for many years.
- RSV is an important cause of **otitis media**. It is estimated that 30–50% of wintertime episodes in infants may be caused by RSV infection.





# Respiratory Syncytial Virus (RSV)

- Presumptive diagnosis of RSV infection in infants can often be made on the basis of the clinical syndrome combined with the time of year and other epidemiologic features. *Late autumn , winter , early spring*
- Radiographic findings are common but relatively nonspecific.
- Rapid detection is desirable to guide the use of appropriate **infection-control measures** and to potentially limit unnecessary antibiotic use. *Isolation for example*  
Immunofluorescence , Real time PCR , antigenic tests all can be used for its diagnosis
- DFA and **RT-PCR** can be used for laboratory diagnosis.  
*Reverse transcriptase PCR is the definitive diagnostic test*



# Respiratory Syncytial Virus (RSV) Rx

- Treatment of serious RSV infections depends primarily on **supportive care** (e.g. removal of secretions, administration of oxygen).

*Its effectiveness isn't significant*

- The antiviral drug **ribavirin** is approved for treatment of lower respiratory tract disease caused by RSV, especially in infants at high risk for severe disease.
- The drug is administered in an **aerosol** for 3–6 days.
- Monoclonal Ab (palivizumab) against RSV has been shown to reduce viral shedding. *Targets fusion proteins of RSV ; given to kids with chronic respiratory infections or immunocompromised individuals to prevent the infection ( IM once monthly )*



# Metapneumovirus infections



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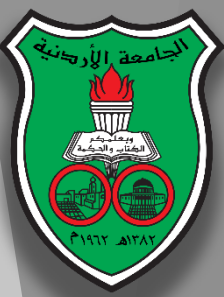
ARTICLES

## A newly discovered human pneumovirus isolated from young children with respiratory tract disease

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# Metapneumovirus infections

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- Human metapneumoviruses are associated with a variety of symptoms of the respiratory tract. These symptoms cannot be distinguished from those induced by RSV. *In almost all respiratory tract infections differentiation is difficult that's why real time PCR is used for diagnosis and differentiation ( molecular detection )*
- Populations at risk besides children include elderly adults and immunocompromised individuals.
- Healthy adults tend to develop cold and flu-like symptoms in response to metapneumovirus infection. Asymptomatic infections are more common than for influenza virus or RSV in this population.
- There is no specific therapy for human metapneumovirus infections, and no vaccine is available.

***Thanks for Listening***