

وَقُلْ رَبِّ زِدْنِي عِلْمًا



RESPIRATORY SYSTEM

HAYAT BATCH



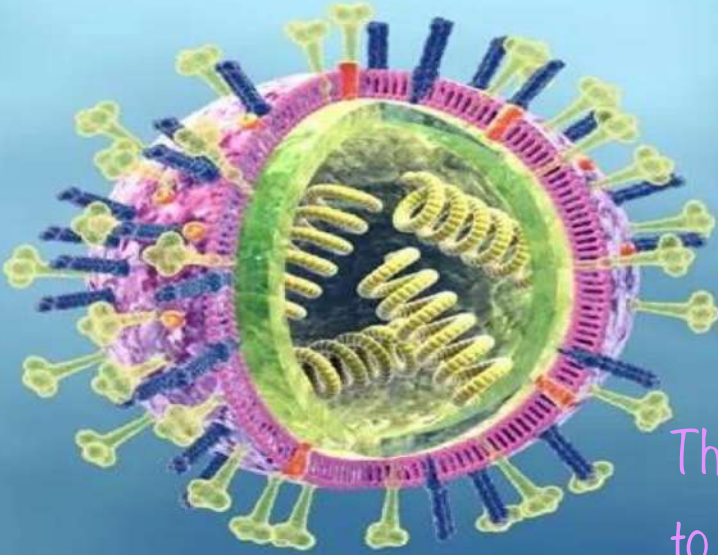
SUBJECT : _____

LEC NO. : 6

DONE BY : Ruba Almashaqba , Tabark Aldaboubi



MYXOVIRUSES



The “myxo-” prefix refers to mucus or mucin

- They are **RNA viruses** which infect the respiratory tract.
- The term “myxo” refers to the affinity of these viruses to mucins (glycoproteins on the host cell surface).
- They are classified into:

A- Orthomyxoviruses: Influenza viruses types A, B, C.

B- Paramyxoviruses:

- Parainfluenza viruses.
- Respiratory syncytial virus.
- Mumps virus.
- Measles virus.



Respiratory System

الدكتورة ركزت على ال highlights

Property	Orthomyxoviruses	Paramyxoviruses
Viruses	Influenza A, B, and C viruses	Measles, mumps, respiratory syncytial, and parainfluenza viruses
Genome	Segmented (eight pieces) single-stranded RNA of negative polarity	Nonsegmented single-stranded RNA of negative polarity
Virion RNA polymerase	Yes	Yes
Capsid	Helical	Helical
Envelope	Yes	Yes
Size	Smaller (110 nm)	Larger (150 nm)
Surface spikes	Hemagglutinin and neuraminidase on different spikes	Hemagglutinin and neuraminidase on the same spike
Giant cell formation	No	Yes

ORTHOMYXOVIRUSES "INFLUENZA VIRUSES"

سبب التسمية اعتقاد
الناس انه هو لعنات من
السماء 🐼

Influenza viruses are important human pathogens because they cause both outbreaks of influenza that sicken and kill thousands of people each year as well as infrequent but devastating worldwide epidemics (pandemics).

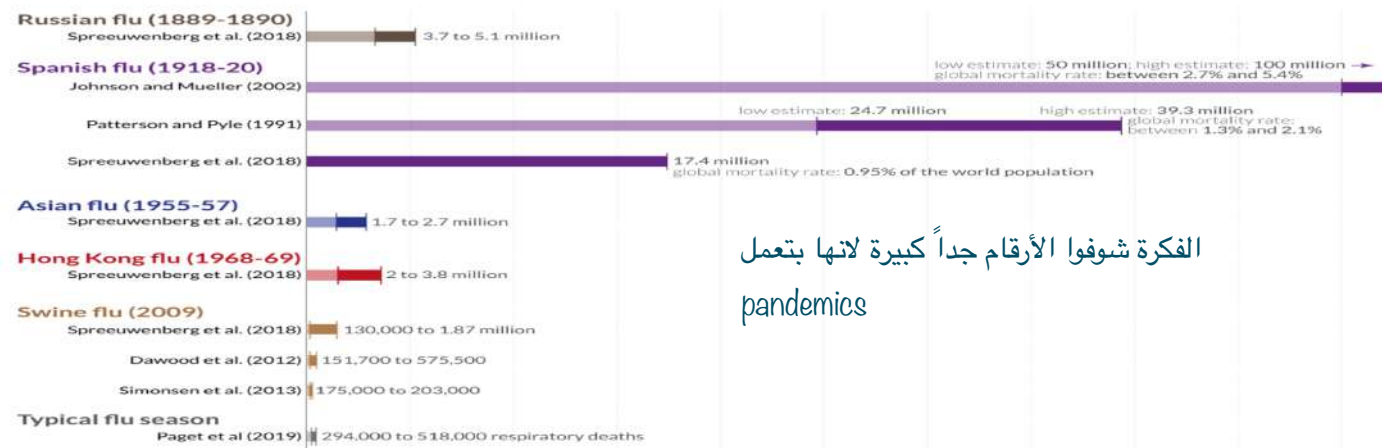


Respiratory System

Global death toll from influenza pandemics

Shown are global mortality estimates from different research publications

Our World in Data



الفكرة شوفوا الأرقام جداً كبيرة لانها بتعمل pandemics

Morphological characters:

➤ Medium sized, Spherical.

➤ Structure:

1) Genome:

• Single-stranded RNA.

• Segmented, eight segments, each segments encode a certain viral protein.

• Negative-polarity (contains RNA-dependent RNA polymerase).

2) Helical capsid symmetry. eight segments → eight Helical

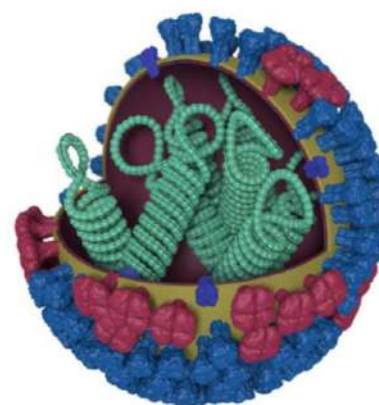
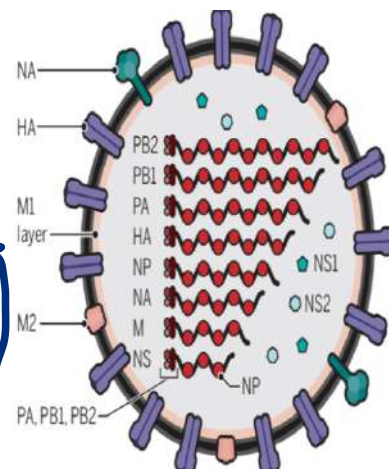
3) Enveloped:

The envelope carries 2 types of projections:

Hemagglutinin spikes (HA) & Neuraminidase spikes (NA).

➤ Influenza virus (and retroviruses) are the only RNA viruses that have an important stage of their replication takes place in the

nucleus. influenza virus + Retroviridae, like HIV → replication in the nucleus



Negative-polarity (contains RNA-dependent RNA polymerase).

بس تتكبر من ال general microbiology بس للفهم

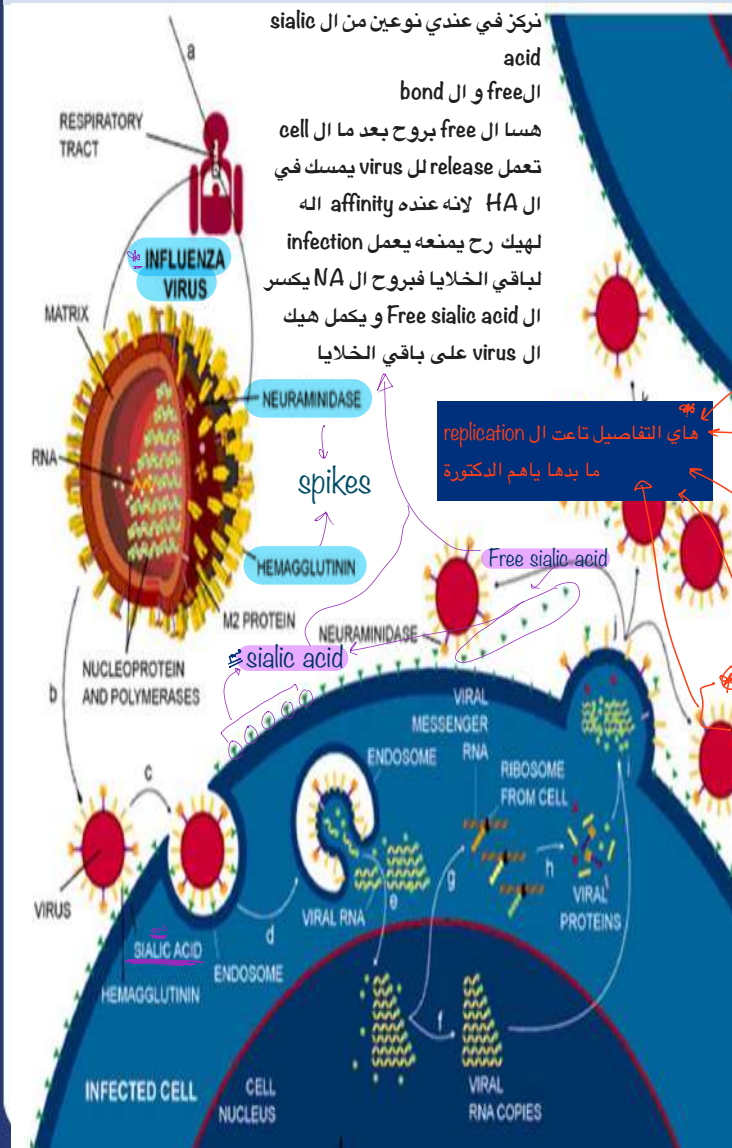
Negative-sense RNA refers to RNA molecules that are complementary to the mRNA (messenger RNA) and cannot be translated directly into proteins. In the case of influenza viruses, their genome consists of single-stranded RNA that is negative-sense. This means that before the virus can replicate and produce proteins, it needs to first synthesize a complementary positive-sense RNA strand using an RNA polymerase enzyme carried by the virus. This complementary strand then serves as a template for protein synthesis. The negative-sense RNA genome of influenza viruses makes them reliant on RNA-dependent RNA polymerase to carry out replication and transcription processes within the host cell.



Respiratory System

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Haemagglutinin spikes (HA)	Neuraminidase spikes (NA)
<ul style="list-style-type: none"> ➤ Bind to the cell surface receptor (neuraminic acid, sialic acid) to initiate (entry) of the cell. ➤ Cleaved by cellular proteases to mediate fusion with endosomal membrane. ➤ HA functions at the beginning of the life cycle. ➤ It is the target of neutralizing antibody (i.e., antibody against the hemagglutinin inhibits infection of the cell). ➤ Agglutinates red blood cells. مهم في ال diagnosis ➤ Encoded by segment 4. 	<ul style="list-style-type: none"> ➤ Degrades the protective layer of mucus in the respiratory tract. ➤ Cleaves neuraminic acid (sialic acid) to release progeny virus from the cell. ➤ Inactivate the free receptor. ➤ NA function at the end of the life cycle. ➤ Antibody against the neuraminidase NOT prevent infection, it reduce amount of virus released, reducing spread of virus. ➤ Encoded by segment 6.



بس ترتيب للجدول على شكل نقاط

1. Attachment and Entry:

- The HA (Haemagglutinin) spikes on the influenza virus bind to the cell surface receptor, typically neuraminic acid (sialic acid), initiating entry into the host cell.
- Cellular proteases cleave HA, mediating fusion between the viral envelope and the endosomal membrane.

2. Transcription and Translation:

- Once inside the host cell, the viral RNA is released (uncoating)
- The viral RNA serves as a template for transcription, producing viral mRNA.
- Viral mRNA is translated by host ribosomes into viral proteins, including HA and NA.

3. Replication:

- Viral RNA-dependent RNA polymerase replicates the viral RNA genome, generating complementary RNA strands.

4. Assembly:

- Newly synthesized viral RNA and proteins are transported to the plasma membrane.
- Viral particles are assembled at the plasma membrane.

5. Budding and Release:

- Viral particles bud from the host cell membrane, acquiring their envelope containing HA and NA.
- NA (Neuraminidase) spikes on the surface of the virus cleave neuraminic acid (sialic acid), releasing progeny virus from the cell and preventing viral aggregation.
- NA also degrades the protective mucus layer in the respiratory tract.

6. Spread:

- Released virus particles can infect neighboring cells and continue the cycle of infection.
- Antibodies against HA inhibit viral entry, while antibodies against NA reduce the amount of virus released, limiting the spread of infection



Respiratory System

Genetic variations of Influenza viruses:

Influenza viruses have two types of antigens:

(1) The internal ribonucleoprotein:

distinguishes influenza into three types; A, B, and C.

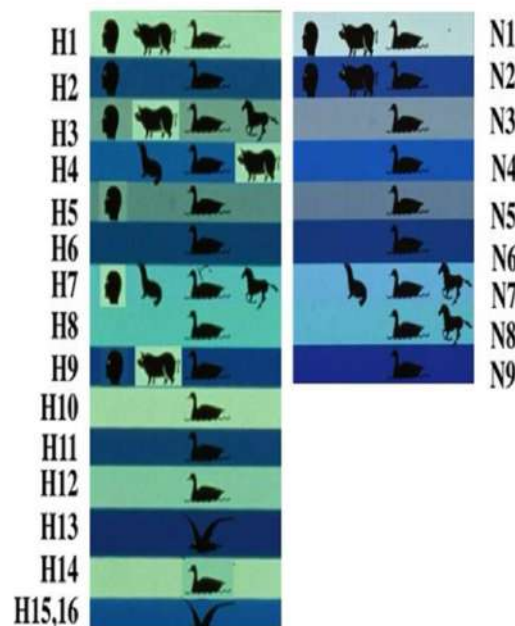
(2) The surface HA & NA:

➤ **Influenza A** virus has **16** antigenically distinct types of **HA** and **9** antigenically distinct types of **NA**.

Some of these types cause diseases in humans, but most of them typically cause diseases in other animal species such as birds, horses, and pigs.

➤ **Influenza B** virus almost exclusively infects humans.

Species Infected by Influenza A, HA and NA Subtypes



تذكروا ايام الرياضيات وحدة الاحتمالات وترد نفس الفكرة ممكن يكون عندك H1 مع N1 او H1 مع N2 وهكذا احتمالات كثيرة + ركزوا كل الأنواع بتعمل infection عند الطيور

➤ **Influenza A & B**, are unique among viruses, that have the ability to change their surface antigens (HA and NA) from time to time. These genetic variations result in emergence of new strains and thus resulting in outbreaks, epidemics or pandemics.

➤ **Type C** is almost antigenically stable, does not cause major outbreaks. It can infect human and pigs.

➤ Two types of antigenic variations can occur in type A & B:

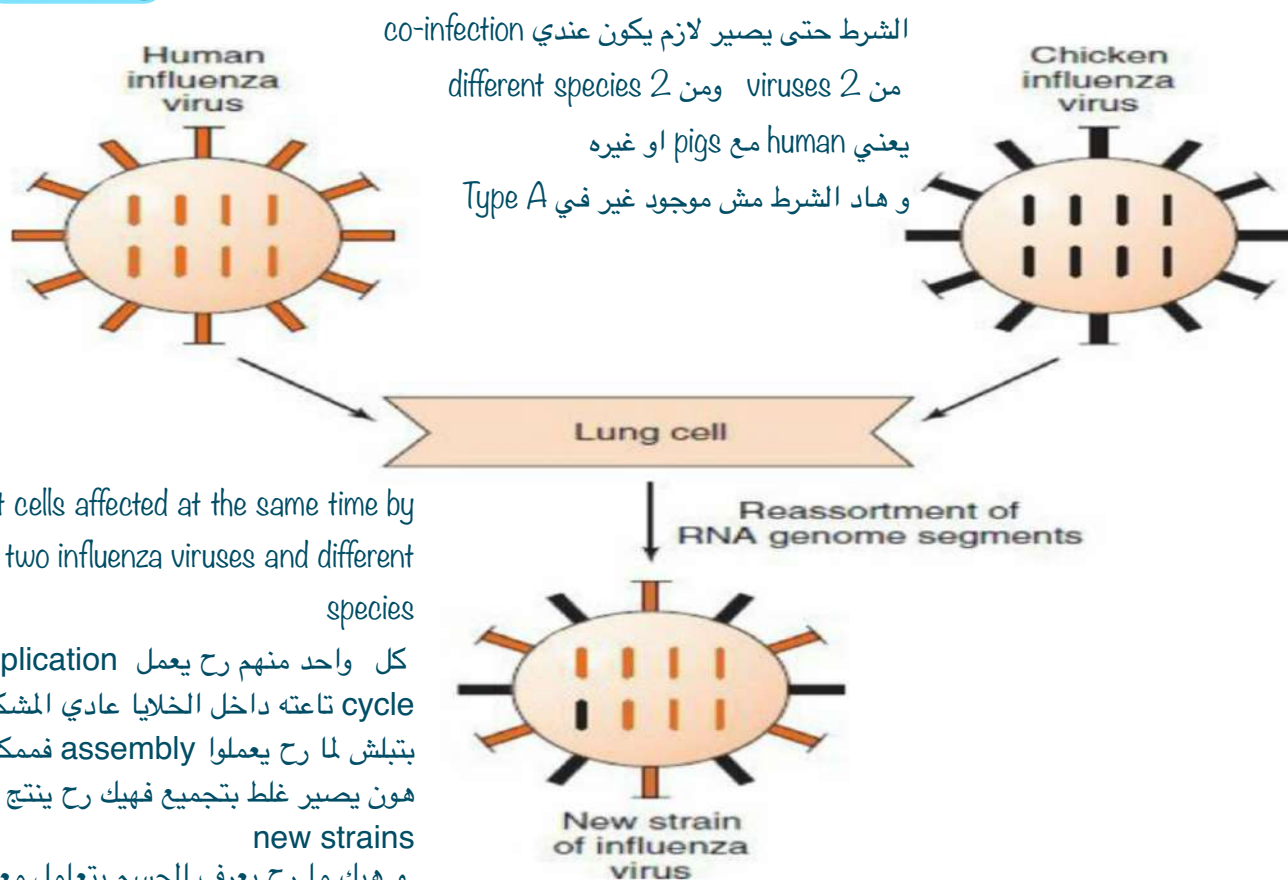
- Antigenic shift.
- Antigenic drift.



Respiratory System

Antigenic shift:

- A **major change** in one or both of surface antigens of the virus.
- Results from **genetic reassortment** between two different virus strains (e.g. one of human and the other of animal origin; avian or swine), when a host cell is infected at “the same time” with both strains.
- In reassortment, **entire segments of RNA are exchanged**, each one of which codes for a single protein (e.g., hemagglutinin).
- Yielding a new strain showing **NO** serologic relationship with the parent strains, so that the preexisting **immunity of population is NO longer effective.** لهيك هي خطيرة
- **Pigs** serve as important “**mixing vessel**” within which the human, avian, and swine viruses reassort.
- Occurs **only in type A** (Not in type B.....Why???) ⬇️⬇️
- Responsible for influenza **pandemics (worldwide epidemics).**
- Although occurs infrequently (10-40 years), it occurs suddenly, unpredictable and drastic **devastating.**

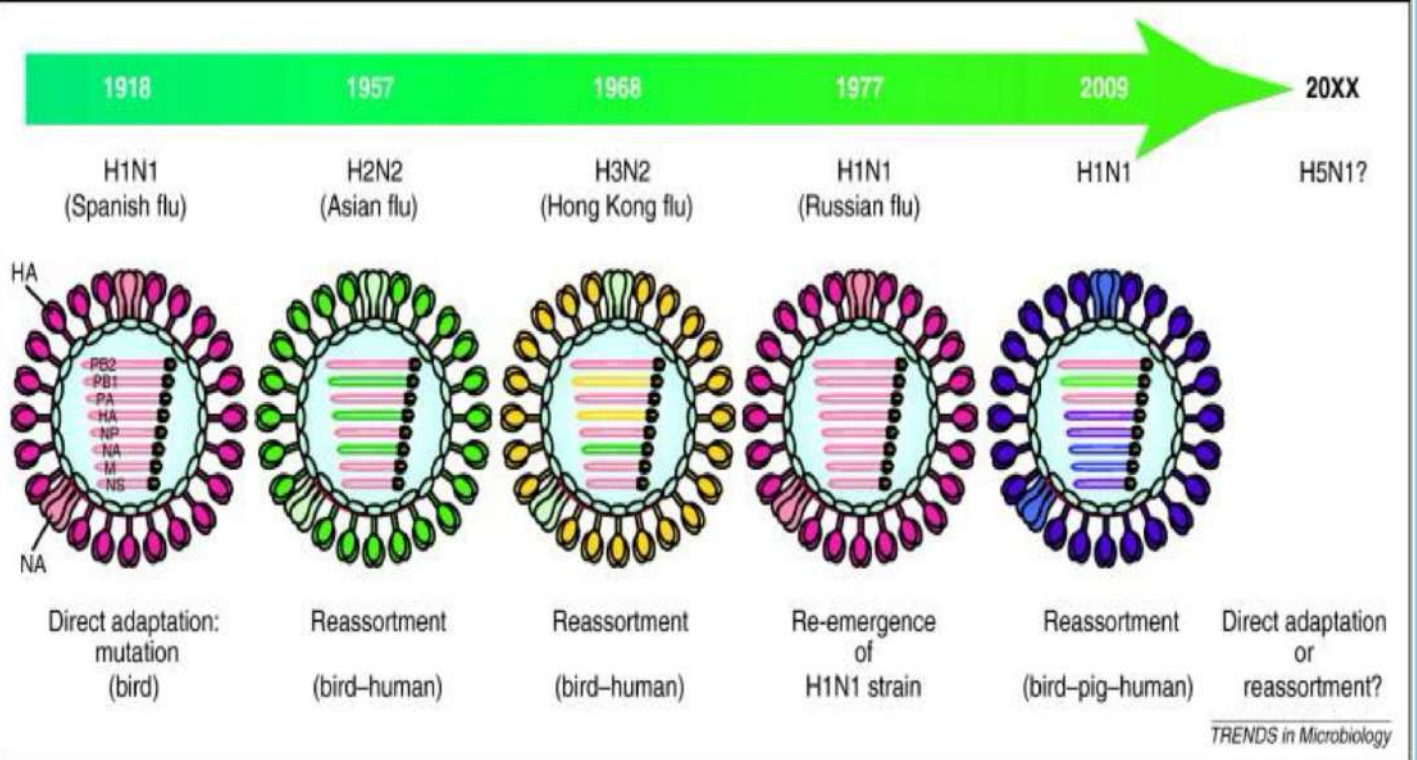


Host cells affected at the same time by two influenza viruses and different species
كل واحد منهم رح يعمل replication cycle تاغته داخل الخلايا عادي المشكلة بتبلش لما رح يعملوا assembly فمممكن هون يصير غلط بتجميع فهيك رح ينتج عندي new strains و هيك ما يعرف الجسم يتعامل معه و بسهولة يطور ل pandemics

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Respiratory System



Antigenic drift:

- A **minor change** in the surface antigenic structure.
- Result from **single spontaneous mutations** in the genome RNA.
- Yielding a strain retaining a **degree of serologic relationship** with the circulating parent strain.
- Occurs in **both types, A and B.**
- Responsible for **yearly influenza outbreaks & epidemics.**

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Respiratory System

Immunoglobulin secreted by mucosal surface → IgA ← يعمل
Attachment للفيروسات Specific receptor
neutralization عن طريق يمنع ال

Immunity against Influenza virus:

- Immunity depends mainly on **secretory IgA** in the respiratory tract.
→ CDA cell
- Cytotoxic T cells also play a protective role.
- Antibody against the **hemagglutinin neutralizes the infectivity** of the virus (prevents disease).
can't prevent disease. (released from infected cell) بالتالي ينتقل ال spread
- Antibody against the **neuraminidase** does **NOT** neutralize infectivity but does reduce disease by decreasing the amount of virus released from the infected cell and thus **reducing spread** of the virus to adjacent cells.
- The disease is **NOT** followed by **long-lasting immunity** because the viruses undergo frequent antigenic variations.
مقل مع الوقت.

Pathogenesis:

- Influenza occurs primarily in the **winter months**.
Prevalant in winter month
- The virus is transmitted by **airborne respiratory droplets**.
طريقته الانتقال
- It causes inflammation in pharynx, larynx, trachea, and **bronchi**. Pneumonia, may also occur.
من اهم اسباب ال bronchitis
- The infection is limited primarily to the respiratory tract because **the proteases that cleave the hemagglutinin are located in the respiratory tract**.
- Although **viremia rarely occurs**, influenza associated with systemic symptoms, e.g. severe myalgias. The systemic symptoms are attributed to **cytokines** circulating in the blood.

!! mucosal surface ليس limited to respiratory
مع اتصال receptor تعلقه (Sialic Acid) موجود بال
the proteases that cleave the hemagglutinin are located in the respiratory tract. ال

وقل رب زدني علما

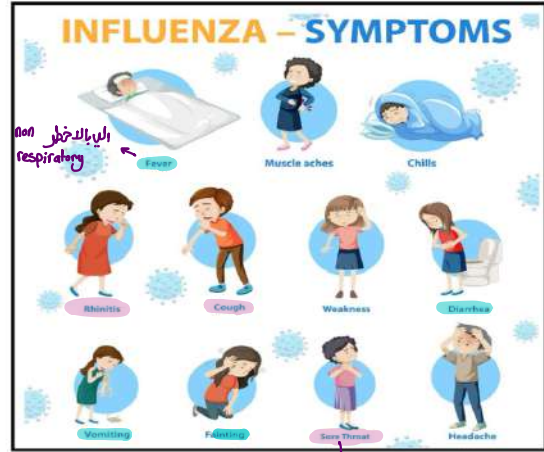


Respiratory System

manifestation → Respiratory →
non Respiratory.

Clinical Findings:

- Incubation period: ^{short} 24 to 48 hours.
- The symptoms usually resolve spontaneously in 4 to 7 days.
- "Severe myalgia coupled with respiratory symptoms are typical of influenza".



Complications:

Very young, elderly, immunocompromised, those with heart or lung diseases are more prone.

- ^{Primary} Influenzal pneumonia. ← يمكن يصير spread لل Virus ويروج على الـ lung وبعك
- Secondary bacterial pneumonia (*Streptococcus pneumoniae*, *Hemophilus influenzae*, *Staphylococcus aureus*).
- **Reye's syndrome:**
 - ✓ Characterized by encephalopathy and liver degeneration.
 - ✓ Is a rare, life-threatening complication in children following some **viral infections**, particularly influenza and chickenpox.
 - ✓ **Aspirin** given to reduce fever in viral infections has been implicated in the pathogenesis of Reye's syndrome.
مخا لينك قوي بين الاسبرلين وحدود الـ Reye's syndrome
لصليك ينصح اي طفل عنده حرارة ما نعطيه Aspirin

هلفتة بعنوان "هانت"

وقل رب زدني علما



Respiratory System

بوخذ عينات ولجلها detection to final عن طريق (ELISA و IF)

Laboratory Diagnosis:

Specimens: nasal or throat washings, nasal or throat swabs, or sputum.

اهم اشئ

1. Detection of viral antigen: by rapid test as ELISA or IF.

مهمة لأن يعطى الادوية مثل
حتى تكون effected !!
لازم تعطى اول
يومية من ظهور الاعراض

The rationale for using the rapid tests is that treatment with the neuraminidase inhibitors should be instituted within 48 hours of the onset of symptoms.

2. Serology: Detection of specific antibodies.

3. Virus isolation: Sample is inoculated in: tissue culture مثل
Monkey kidney tissue cultures or Amniotic cavity of chick embryo:

The virus is detected by hemagglutination or hemadsorption tests and typed by hemagglutination or hemadsorption inhibition with specific antisera.

Treatment:

1) Amantadine and its analogues, rimantadine (given orally):

- Effective **only against influenza A**, NOT against influenza B.
- These drugs act by **inhibiting uncoating** of the virus. يشغلوا عن طريق انهم يجلوا

2) Neuraminidase inhibitors: Oseltamivir (Tamiflu, Oral) and zanamivir (Relenza, Inhalant):

- Effective against **both influenza A and B** viruses.
- Act by inhibiting the release of virus from infected cells, and therefore **reduce** the chance of spread from one cell to another. متي يكون effected بتعطيل خلال اول يومين
- To be effective, these drugs must be given **within 48 hours of the onset** of symptoms. They reduce the duration of symptoms by 1 to 2 days.

Note that, these drugs approved for both treatment and prevention of severe manifestations and complications and so, should be **considered in high risk groups.**

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inhibition to Neuraminidase → inhibite release of virus → reduce spread the virus

جلوا minimization disease من ناحية الـ duration and severity عشان هيك يكونوا

high risk group بالـ recommended



Respiratory System

Prophylaxis: Influenza Vaccines

- Contains **both influenza A and B viruses**. كل انواع ال Vaccine و Influnza تحتوي به
- The vaccine is usually **reformulated each year** to contain the current antigenic strains. كل سنة و ذال Influnza Virus بالتالي ال Vaccine بتغير كل سنة
- These vaccines especially **recommended for those at high risk**. Yearly boosters are recommended and should be given shortly before the flu season (e.g., in October).
- **Types of influenza vaccines:**

1- **Inactivated whole virus vaccine:** given by injection

2- **Subunit (subvirion) vaccine:** contain purified HA and NA glycoproteins. in injection

3- **Live attenuated vaccine:** given intranasally.

- The virus replicate in the cooler (33°C) nasal mucosa where they induce IgA.
- The live vaccine should **not** be given to pregnant women or to immunocompromised individuals.

لصيت اوله فومين استخوانه common اكثر
live virus فلما يدخل بجمل replication في ال nasal mucosa لصيت بجمل induce immunity بصورة IgA بجمل
better immunity عن بقتة اللقاح

Disadvantages of influenza vaccines:

- 1- Immunity is **NOT absolute & NOT long lasting** (moderate degree of protection 50-80%).
- 2- Immunity is only for the virus strain contained in the vaccine.
- 3- Because vaccine is **prepared in eggs**, the egg proteins may lead to **hypersensitivity**.

In 2012, Food and Drug Administration (FDA) approved two types of vaccines:

- 1 • A killed influenza vaccine (Flucelvax) made in calf kidney cell culture.
- 2 • A recombinant vaccine (Flublok) made by genetic engineering (contains purified hemagglutinin).

بكونوا safe وما بيمس منهم حساسية

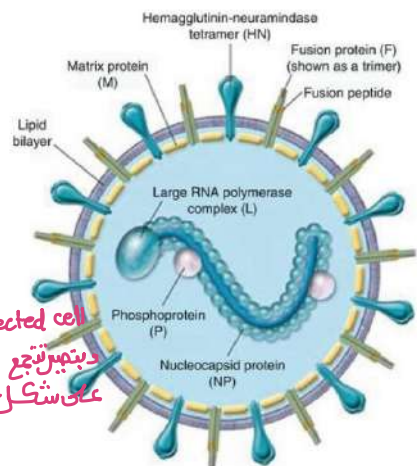
These vaccines can be given to those with egg allergy.



PARAINFLUENZA VIRUS

Morphological characters:

- Medium sized, Pleomorphic.
- **Genome:**
 - **Non-segmented** single-stranded RNA genome.
 - **Negative-polarity** (RNA-dependent RNA polymerase).
- **Helical capsid symmetry.**
- **Enveloped:**
 - The envelope carries 2 types of spikes:
 - 1. **Hemagglutinin-Neuraminidase (HN)** on the same spike and **Fusion (F)** on a separate spike. *lose the septa between effected cell*
 - F protein mediates the formation of multinucleated giant cells (syncytia). *دبتين تجمع على شكل*
 - Replication takes place in the **cytoplasm**.



*RNA
Virus*

Pathogenesis & Clinical Findings:

- These viruses are transmitted via respiratory droplets.
- There are four types, 1, 2, 3, 4 and two subtypes 4a and 4b. *inflammation and edema of upper respiratory tract*
- Parainfluenza viruses (**type 1 and 2**): are **major causes of croup** (acute laryngo-tracheobronchitis) in children younger than 5 years of age. Clinically it presents with fever, barking cough, hoarseness of voice and inspiratory stridor due to mucosal edema. *دisease affected*
- Parainfluenza viruses (**type 3**): Bronchiolitis and pneumonia in young children and infants.
- Parainfluenza virus (**type 4**): rarely causes disease, except for the common cold.



Inverted V sign



Respiratory System

قراءته الدكتور فريدة (لعو نفس) الـ diagnosis تابعة النوع الـ (influenza virus)

Laboratory Diagnosis:

1. Detection of viral antigen: in respiratory secretions by IF or ELISA.
2. Virus isolation: samples are inoculated in monkey kidney tissue cultures. The virus is detected by hemadsorption of human group O RBCs or by IF. Typing of the virus is done by hemadsorption inhibition test by standard antisera.
3. Serology: Neutralization, HI, CF tests can be used.

Treatment & Prevention:

There is neither specific antiviral therapy **NO vaccine**.

Management of croup.

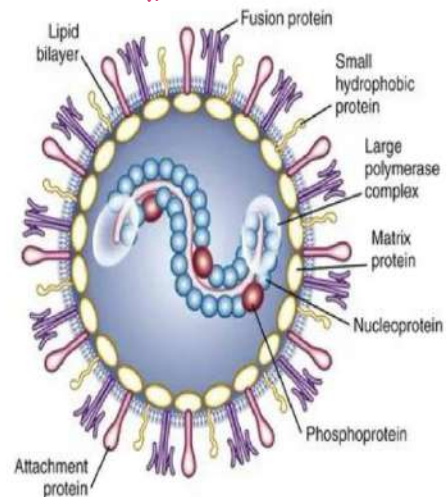
Corticosteroid
epinephrine
inflammation و edema الـ لتقليل
سبتخم

RESPIRATORY SYNCYTIAL VIRUS

زيب الـ parainfluenza
spike الـ
virus

Morphological characters:

- Medium sized, Pleomorphic.
- **Genome:**
 - **Non-segmented** single-stranded RNA genome.
 - **Negative-polarity** (RNA-dependent RNA polymerase).
- **Helical capsid symmetry.**
- **Enveloped:**
 - Its surface spikes are ¹ **fusion (F)**, ² **attachment (G)** **NOT** hemagglutinins or neuraminidases
 - The **F** protein causes cells to fuse, forming **multinucleated giant cells (syncytia)**, which give rise to the name of the virus.
اسم الفيروس نشأ عن على
 - Replication takes place in the **cytoplasm**.
اساسها



وقل رب زدني علما



Respiratory System

Epidemiology:

فهي نوعين من الفيروس

- RSV has two serotypes, designated subgroup A and subgroup B.
- Transmission occurs via respiratory droplets and by direct contact of contaminated hands with the nose or mouth.
- RSV causes outbreaks of respiratory infections every winter and also causes outbreaks of respiratory infections in hospitalized infants and in childcare nurseries.
- RSV occurs worldwide, and virtually everyone has been infected by the age of 3 years. واسع الانتشار بين الطفل ليوصل سن 3 سنوات بدون اخذ على الاقل عدوى مرة من هاجم الفيروس
- Multiple infections can be caused by RSV, indicating immunity is incomplete.

Clinical Findings:

- RSV is **the most important** cause of lower respiratory tract diseases such as **bronchiolitis and pneumonia in infants < 1 year**.
(Cough, wheezing and respiratory distress with hypoxia & hypercapnia).
The disease is more severe in infants with congenital heart disease & congenital immunodeficiency disease.
- RSV is also an important cause of otitis media in young children.
- In older children and young, healthy adults, RSV causes respiratory tract infections such as the common cold and bronchitis.



Respiratory System

* نفس المري بيافى انواع الفيروسس المري فوق

Laboratory Diagnosis:

- 1. Detection of viral antigen:** in respiratory secretions by IF or ELISA.
- 2. Virus Isolation:** respiratory secretions are inoculated in the HeLa or HEP-2 cells. The characteristic CPE of **syncytia of multinucleated giant cells** can be seen. The presence of virus is confirmed by IF.
- 3. Serology:** serum antibodies can be assayed by IF, ELISA, CF and neutralization tests.



واحدة جدا بتكون

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Treatment & Prevention:

- Aerosolized ribavirin is recommended for severely ill hospitalized infants.
- Bronchodilators, corticosteroids and oxygenation in severe cases.
- There is NO vaccine.

Anti viral drug ↓



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Respiratory System

1) A pharmaceutical scientist discovers a new drug that can inhibit the binding of the influenza virus to respiratory epithelial cells in subjects. Which of the following proteins is most likely being targeted with this drug?

- A) gp41
- B) Hemagglutinin
- C) gp120
- D) sialic acid
- E) Neuraminidase

Correct answer =
B) Hemagglutinin

2) A patient presents to the primary care clinic for a routine wellness visit in October. As part of the visit, he is administered an intramuscular influenza vaccine. Which of the following best describes the type of vaccination this patient received?

- A) Subunit vaccine
- B) Live attenuated vaccine
- C) Messenger RNA vaccine
- D) Inactivated vaccine

Correct answer =
D) Inactivated vaccine

3) A patient presenting to the emergency department with fever, headache, myalgia, and runny nose is found to have influenza. Which of the following best describes the viral characteristics of this pathogen?

- A) Single-stranded DNA
- B) Negative-sense, single-stranded RNA
- C) Positive-sense, single-stranded RNA
- D) Double-stranded RNA
- E) Double-stranded DNA

Correct answer = B) Negative-sense, single-stranded RNA



Respiratory System

4) A team of researchers is attempting to develop a new pharmacotherapy for the treatment of respiratory infections. Pathogen X, as identified by the researchers, is introduced to an in vitro model consisting of human nasopharyngeal epithelial cells grown within a culture container. Pathogen X is found to produce an enzyme that binds sialic acid residues on the surface of nasopharyngeal epithelial cells. This enzyme allows pathogen X to subsequently enter the epithelial cells. Clinically, pathogen X causes symptoms including shortness of breath, fevers, myalgias, and joint pain. Furthermore, infection by pathogen X can predispose patients to subsequent infection by *Staphylococcus aureus*. Which of the following is the most likely identity of pathogen X?

Correct answer =
=Influenza virus

- A) *Mycoplasma pneumoniae*
- B) Influenza virus
- C) *Legionella pneumophila*
- D) Cytomegalovirus
- E) *Streptococcus pneumoniae*

5) An epidemiologist is studying major influenza outbreaks over the past century. In particular, the epidemiologist is investigating the 2009 worldwide outbreak of H1N1 influenza. Which of the following genetic events was the most likely cause of that outbreak?

Correct answer =
B) RNA segment reassortment

- A) Point mutation in neuraminidase
- B) RNA segment reassortment
- C) Point mutation in hemagglutinin
- D) Nonsense mutation in neuraminidase
- E) Missense mutation in hemagglutinin

Single stranded
Negative strand
Helical
Enveloped

Orthomyxoviridae

Influenza virus

Common characteristics

- Negative-strand RNA genome
- Spherical, enveloped, pleomorphic virus
- RNA is segmented into eight pieces
- Virion has two types of membrane protein spikes: H protein (hemagglutinin) and N protein (neuraminidase)
- Virion contains RNA polymerase

Pathogenesis/Clinical Significance	Treatment and Prevention	Laboratory Identification
<p>Influenza is spread by respiratory droplets and is an infection solely of the respiratory tract. There is rarely a viremia or spread to other organ systems.</p> <p>Influenza viruses are classified as types A, B, and C, depending on the antigenicity of their inner proteins (only A and B are of medical importance). Type A viruses are further broken down into subtypes based on antigens associated with the outer viral proteins, H and N. Influenza viruses have shown marked variation over the years in their antigenic properties, specifically of the H and N proteins. This variation is due primarily to antigenic shift.</p> <ul style="list-style-type: none"> ● Influenza (the "flu") Following inhalation of influenza virus particles, respiratory epithelial cells are destroyed by the host immune response, specifically, cytotoxic T cells. Typically, influenza has an acute onset characterized by chills, followed by a high fever, muscle aches, and extreme drowsiness. The disease runs its course in 4 to 5 days, after which there is a gradual recovery. The most serious problems, such as pneumonia, occur in the very young, older adults, and people with chronic cardiac or pulmonary disease, or who are immunodeficient. ● Reye syndrome This is a rare and serious complication of viral infections in children, especially in those who have had chickenpox or influenza. Aspirin used to lower the virus-induced fever may contribute to the appearance of this syndrome. Therefore, acetaminophen is usually recommended for fevers of unknown origin in children. 	<ul style="list-style-type: none"> ● Treatment: Amantidine and rimantidine prevent the influenza virus from uncoating. They reduce both the duration and severity of flu symptoms in type A influenza infections, but only if given early in infection. Influenza viruses readily develop resistance to these compounds. Zanamivir and oseltamivir are newer drugs that inhibit viral neuraminidase, an enzyme required for release of virus from infected cells. ● Prevention: A vaccine consisting of formalin-inactivated influenza virus is available. It is of critical importance that the vaccine contain the specific subtypes of influenza virus present in the population that year. Given before the onset of symptoms, amantidine and rimantidine can also prevent disease, and are useful for treating high-risk groups. A live, attenuated influenza virus vaccine, administered intranasally, has also been approved. 	<ul style="list-style-type: none"> ● Quantitation of antibodies that inhibit hemagglutination can be done for surveillance purposes. ● Demonstration of viral antigens in respiratory tract secretions is a more rapid method for diagnosis of influenza infection. ● Detection of viral RNA by reverse transcription polymerase chain reaction is sensitive and specific.

Viruses – RNA NEG Sense



Orthomyxovirus – Night Shift at the Orthodontist's

1. Moon w/ orange hues – RNA NEG Single Strand virus
2. All RNA Negs Bring along their own Polymerase
3. Babies in the helmet - Replicates in the nucleus
4. Orthodontist in the coat – Enveloped
5. FLU-oride poster w/ ABC – most common cause of the flu, strains ABC
6. Octopus w/ 8 arms – 8 segments, so there is 8 places where it can mutate. Antigenic shift and drift
7. DOKTAR DRIFT- **Antigenic drift** is **point mutations** in the viral genome leading to changes in the hemagglutinin (HA) and neuraminidase (NA) molecules. Seasonal flu and epidemics
8. Night Shift, h is falling down to symbolize assortment of genes. - **Antigenic shift** is when segments are shared to form a new species. Segment changes and pandemics.
9. Multiple color curtains – antigenic shift
10. Three main influenza viruses – A causes epidemics and pandemics (Antigenic shift) – B causes epidemics (antigenic drift)
11. Heme Aquarium, Octopus sitting on RBC's, and sialic chains on the helmet – Hemagglutinin (HA), this is a glycoprotein that binds to sialic acid found in membranes in Upper respiratory and RBCs causing them to clump.
12. HA Antigens, H1, H2, H3, - define cell tropism (cells that can be affected) – HA molecule will bind to sialic acid on the cell membrane, then endocytosed into the cell, pH needs to be changed by M2 protein to allow for uncoating.
13. Shell with octopus and 2 M's – M2 Protein
14. Manta ray – Amantadine, Rimantadine inhibit M2 so no uncoating. But allows increased dopamine release in CNS
15. Octopus w/ knife that is missing from Nurse Assistants tray - Neuraminidase (NA) – allows break virus free from sialic acid inside the host cell
16. Nurse name is TamV(Tamiflu) she is capping all of the scalpels: trade name for Oseltamivir/Anamivir: NA inhibitors blocking release of virus
17. Droplets coming off the aquarium – Flu spread by respiratory droplets
18. Pirates skeleton – killed virus IM
19. Bubbles in nose – Live vaccine
20. Orthodontist inspecting mouth w/ gold staff - Staph aureus pneumonia
21. Sun with rays - Reyes syndrome – aspirin associated with treatment causing encephalitis, and hepatomegaly. Will uncouple mitochondria proton gradient along the electron transport chain in the hepatic cells.
22. Stuffed bear on boys back - Guillen Barre syndrome – ascending paralysis – Finding high protein with low WBC's