

A close-up photograph of a horse's muzzle. The horse has a white blaze running down the center of its face. The skin around the nostrils and the lower part of the muzzle appears irritated, with some yellowish, crusty discharge visible. The horse is wearing a brown leather halter with metal buckles and rings. The background is a blurred, dark brown color, likely a stable wall or floor.

Equine Influenza

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Equine influenza (EI) is a highly contagious respiratory disease that affects horses, donkeys, mules, and zebras.

Clinical signs can include:

- ◆ Fever;
- ◆ Malaise;
- ◆ Nasal discharge; and
- ◆ Cough.



Definitions You Need to Know

Fomites • Objects or materials that are likely to carry infection.

Herd Immunity • The resistance to the spread of a contagious disease within a population that results if a sufficiently high proportion of individuals are immune to the disease, especially through vaccination.

Viremia • The presence of viruses in the blood.

Virus • An infective agent that typically consists of a nucleic acid molecule in a protein coat; is too small to be seen by light microscopy; and is able to multiply only within the living cells of a host.

The virus that causes EI is spread via saliva and respiratory secretions from infected horses. Horses are commonly exposed by:



- ◆ Horse-to-horse contact;



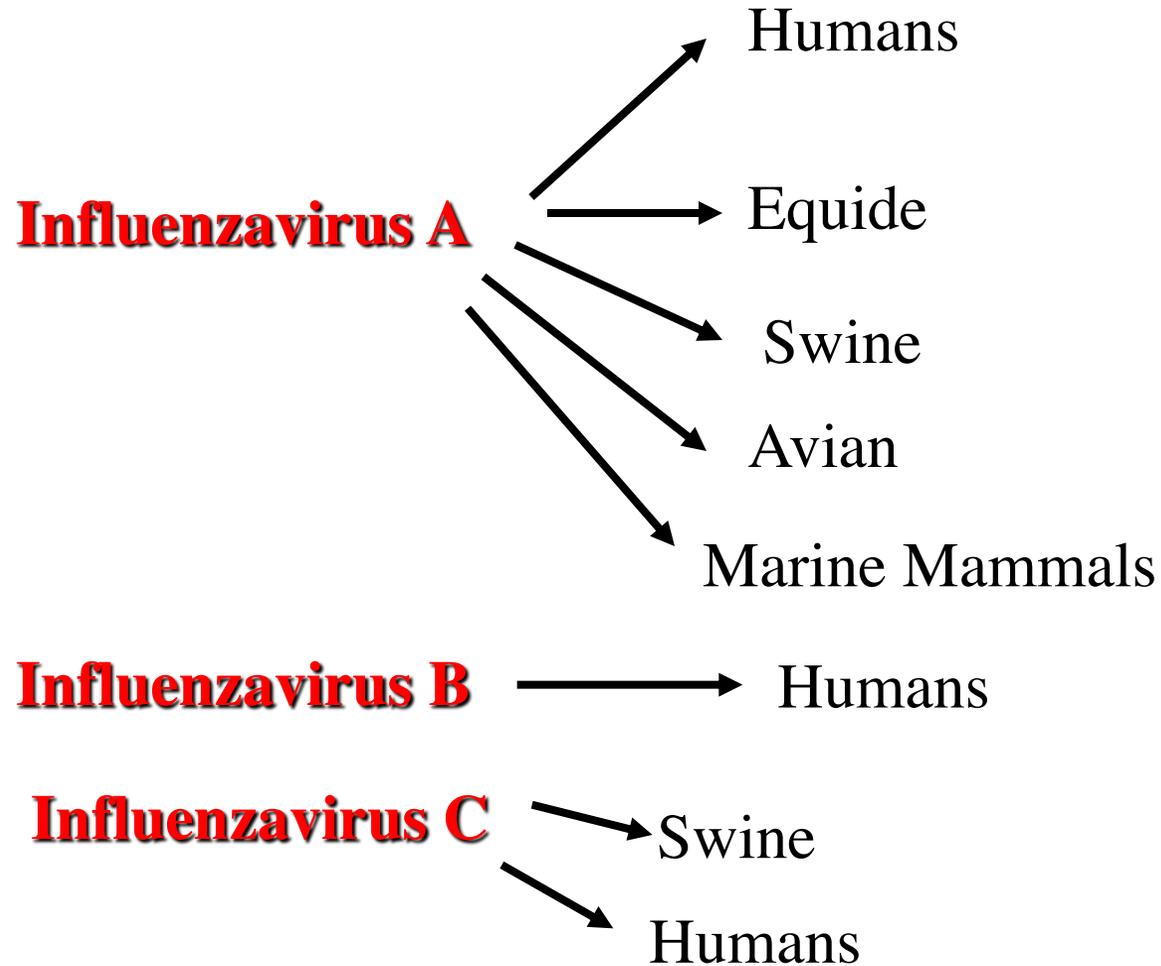
Equine Flu

- Equine Influenza (EI) is a highly contagious though rarely fatal respiratory disease of horses, donkeys and mules and other equidae.
- Nowadays outbreaks still have a severe impact on the horse industry.



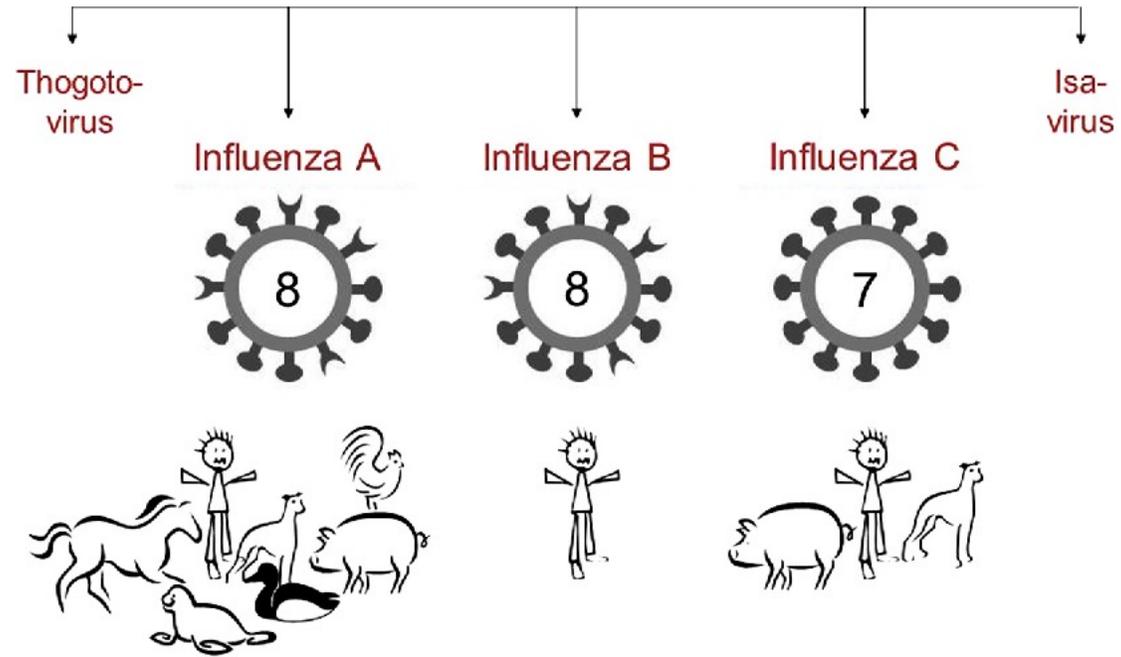
**EQUINE
INFLUENZA
KNOW THE THREAT**

Orthomyxoviridae

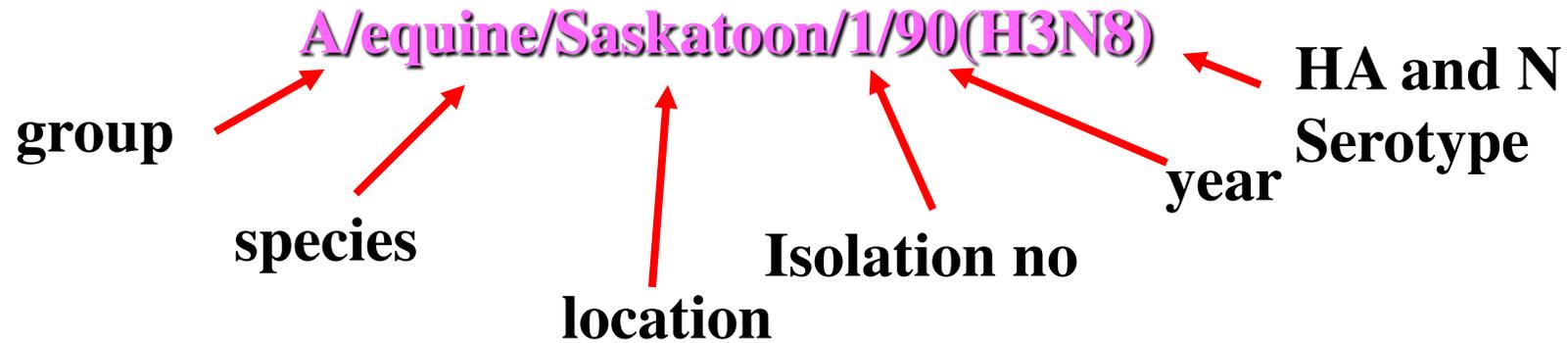


Family: *Orthomyxoviridae*

5 Genera



Nomenclature



- A/equine/Prague/1/56(H7N7)
- A/fowl/Hong Kong/1/98(H5N1)
- A/swine/Lincoln/1/86(H1N1)

Distribution of HA serotypes in nature

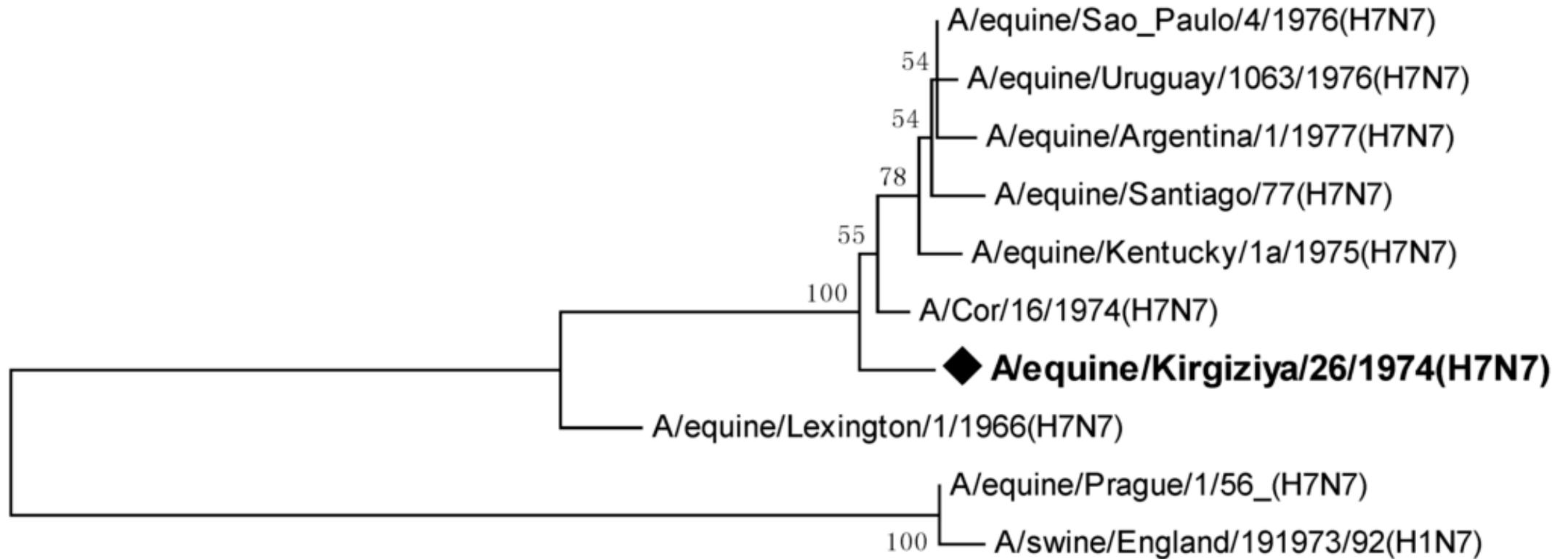
<u>HA serotype</u>	<u>Avian</u>	<u>Horse</u>	<u>Swine</u>	<u>Human</u>
HA1	yes		yes	yes
HA2	yes			yes
HA3	yes	yes	yes	yes
HA4	yes			
HA5	yes			yes
HA6	yes			
HA7	yes	yes		
HA8-16	yes			

HA16 was detected in the most recent seagull.

Distribution of N serotypes in nature

<u>N serotype</u>	<u>Avian</u>	<u>Horse</u>	<u>Swine</u>	<u>Human</u>
N1	yes		yes	yes
N2	yes		yes	yes
N3	yes			
N4	yes			
N5	yes			
N6	yes			
N7	yes	yes		
N8	yes	yes		
N9	yes			

In horses two types are available,
Type 1 (H7N7) and Type 2 (H3N8)



0.005

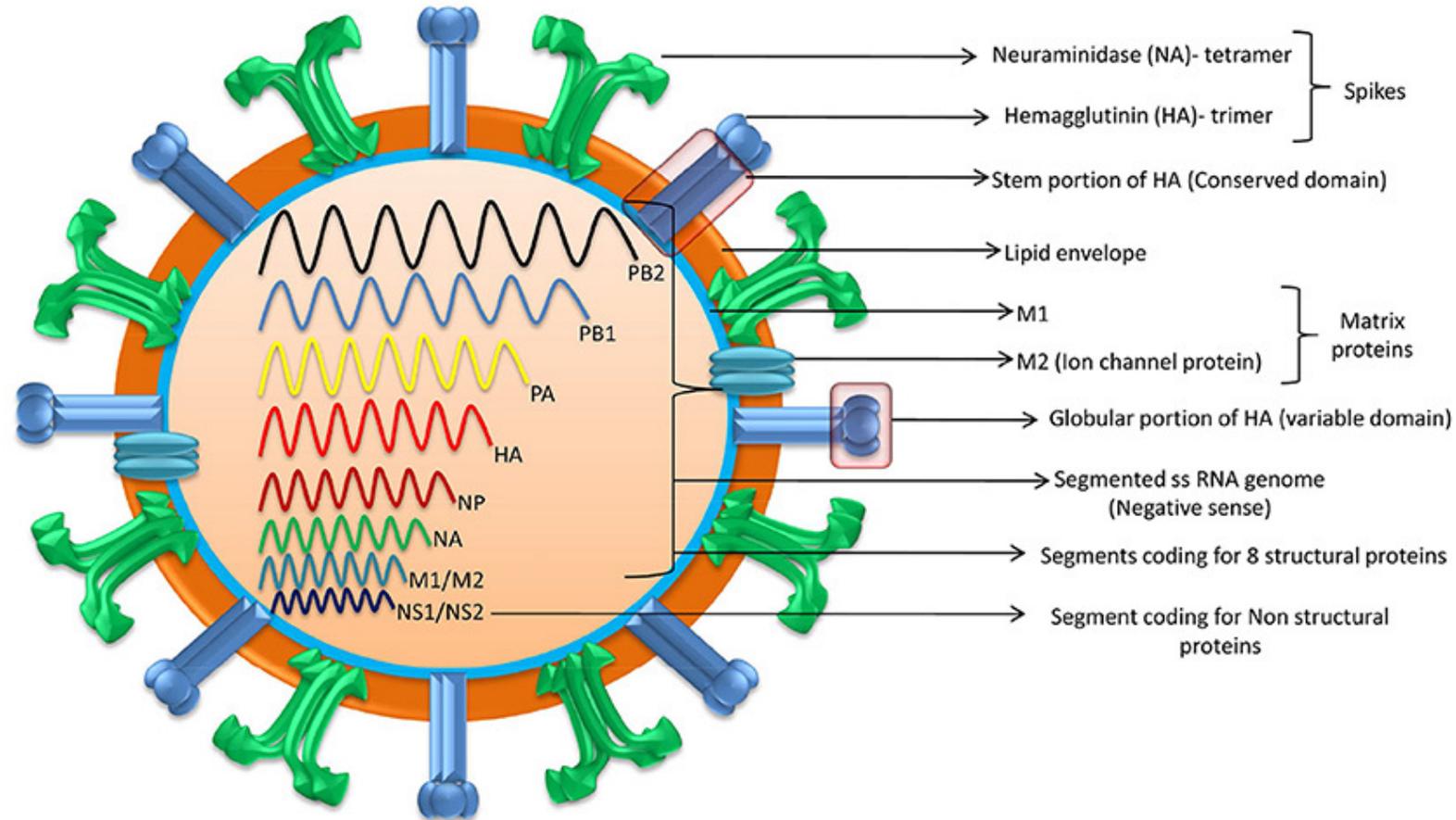
Significant A-type influenza epidemics

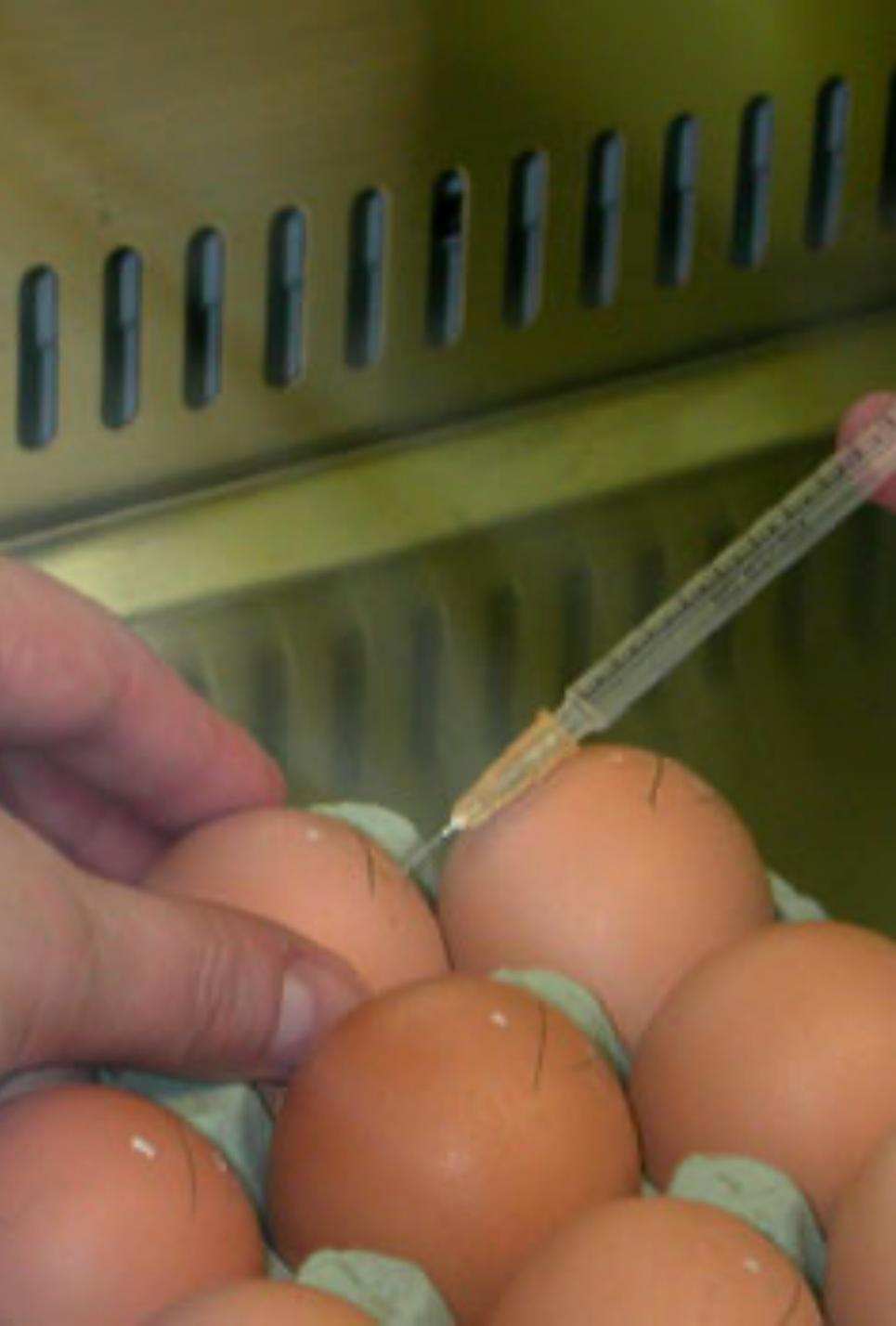
- [H1N1](#), which caused [Spanish Flu](#) in 1918, and [Swine Flu](#) in 2009
- [H2N2](#), which caused [Asian Flu](#) in 1957
- [H3N2](#), which caused [Hong Kong Flu](#) in 1968
- [H5N1](#), which caused [Bird Flu](#) in 2004
- [H7N7](#), which has unusual [zoonotic](#) potential^[24]
- [H1N2](#), endemic in humans, pigs and birds
- [H9N2](#)
- [H7N2](#)
- [H7N3](#)
- [H10N7](#)

Etiology

- Orthomyxoviridae, Influenzavirus
- Segmented, enveloped, single stranded RNA
 - The single stranded RNA is negative sense, It has a different gene on each segment. Each gene codes for one protein: **haemagglutinin** (H) spike, neuraminidase (N) spike, matrix , nucleoprotein, 3 viral polymerases and a large non-structural protein.
- HA and N
 - H enables the virus to attach to respiratory epithelial cells within seconds via sialic acid on the host cell. H also attaches to red blood cells in-vitro, hence its name. Such haemagglutination is blocked when virus is pretreated with antibody (Haemagglutination inhibition (HI) test).
 - N is a sialidase enzyme which prevents new virus simply reattaching to the same host cell and allows it to move to new cells

Etiology





Etiology

Influenza viruses are routinely grown to high titre in the allantoic cavity of 10-day-old embryonated eggs.

Rarely in kidney cells for vaccines and diagnosis. Virus is detected by its ability to haemmagglutinate red blood cells.

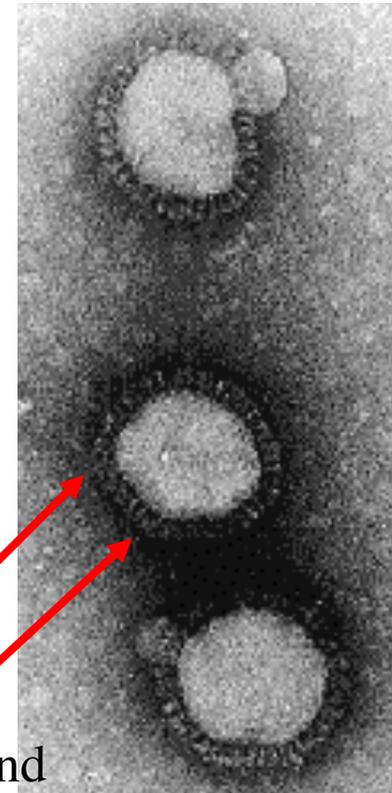
- Virus cause cpe in cell culture.
- Under natural conditions it is only seen on equids.
- They are related to but distinct from the viruses that cause human and avian influenza.

Etiology



Nucleocapsid
(RNA surrounded with
protein)

envelope

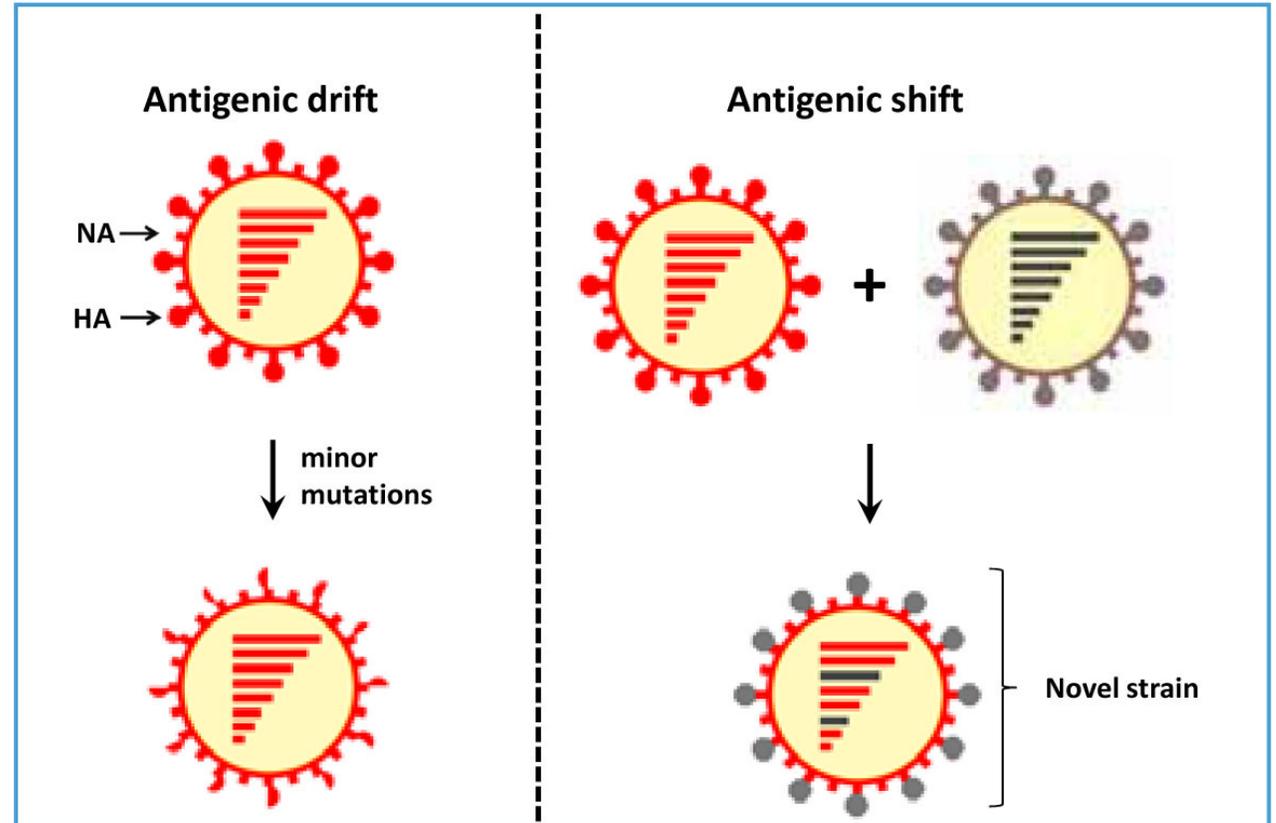


haemagglutinin and
neuraminidase “spikes”
on envelope

100 nm

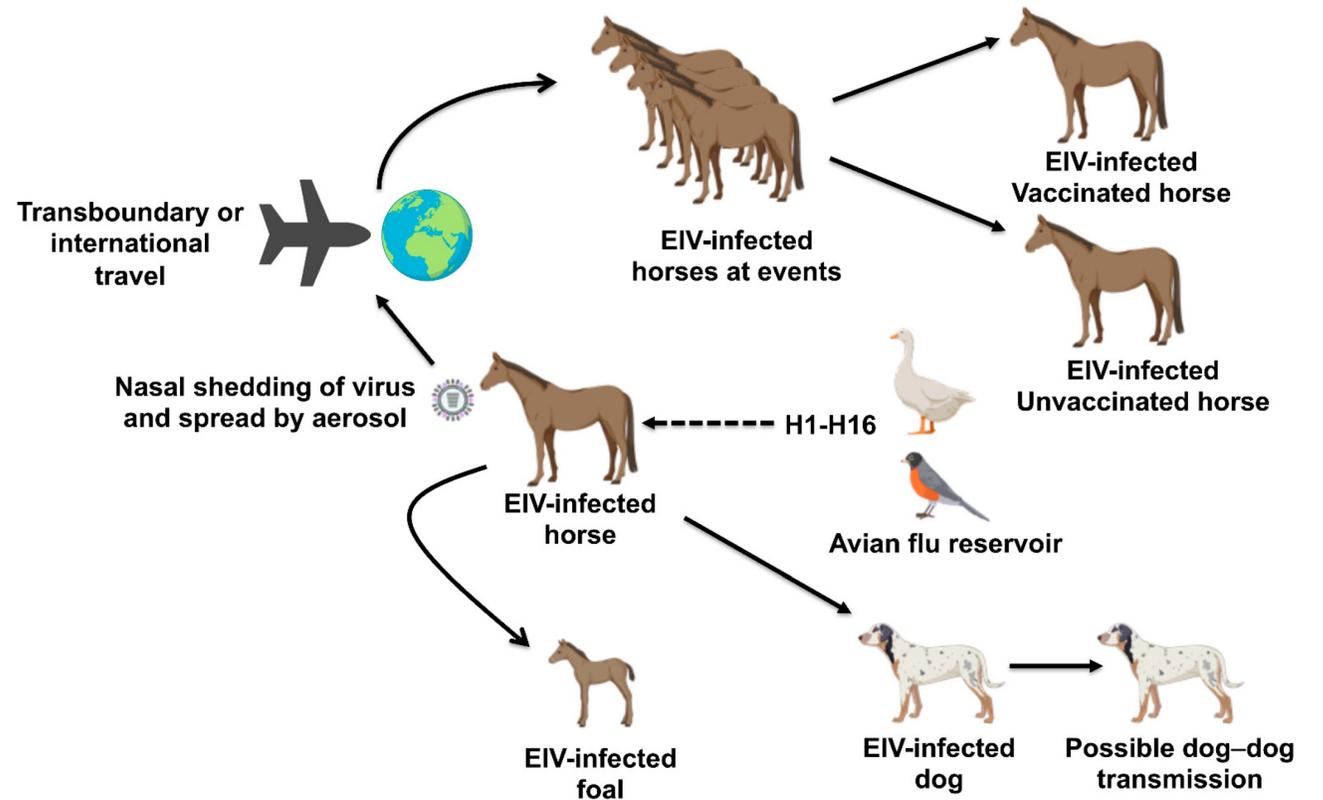
Antigenic drift - variation of H within a subtype within a host species.

Antigenic shift - change of subtype of H within a host species.



Transmission

- Virus is highly contagious.
- EI is spread by contact with infected animals, which in coughing excrete the virus.
- In fact, animals can begin to excrete the virus as they develop a fever before showing clinical signs.
- It can also be spread by mechanical transmission of the virus on clothing, equipment, brushes etc carried by people working with horses.



DID YOU KNOW...

FLU CAN SPREAD UP TO 5KM?

Incubation period

Three days, spreads quickly and is capable of causing explosive outbreaks.

Equine Influenza Outbreak

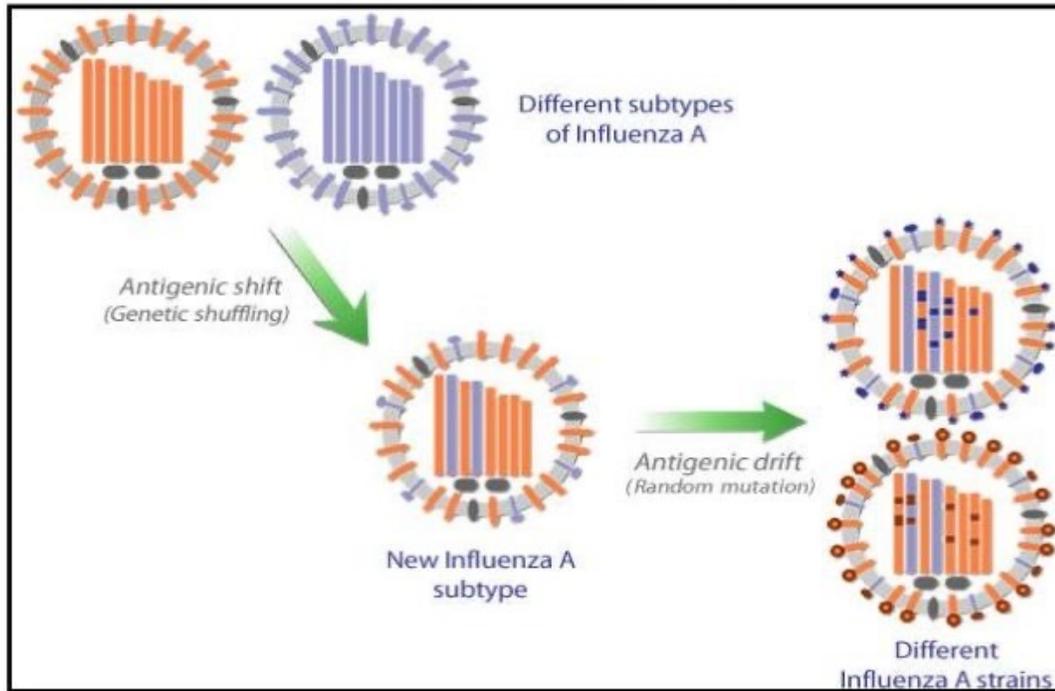


Factors
Strengthening
Epizootics /
Epidemics

- Antigenic drift
- Reassortment and antigenic shift
- Short-term immunity
- Transfer between species
 - It is known to pass through dogs.

- **Antigenic drift**
- evolution of a variant within a subtype, meaning imperfect protection by old vaccines
- *Why?* Each H molecule carries 5 antigenic regions via which antibodies can HI, neutralize and block attachment to host cells. A change in any region results in antigenic drift. The RNA genes of influenza are constantly mutating, during error-prone replication. If the mutation involves escape from neutralisation the variant is selected in infected animals.
- Drift is detected by 2-4-fold alterations in HI titres between one isolate and another isolate recovered several years later. Drift is now best assessed by panels of mAb in HI tests and nucleotide sequencing of the neutralisation sites on H.
- These **mutations accumulate with time**. The human viruses appear to accumulate more mutations than the equine, which may relate to the presence of more people than horses in the world.

Reassortment cont..

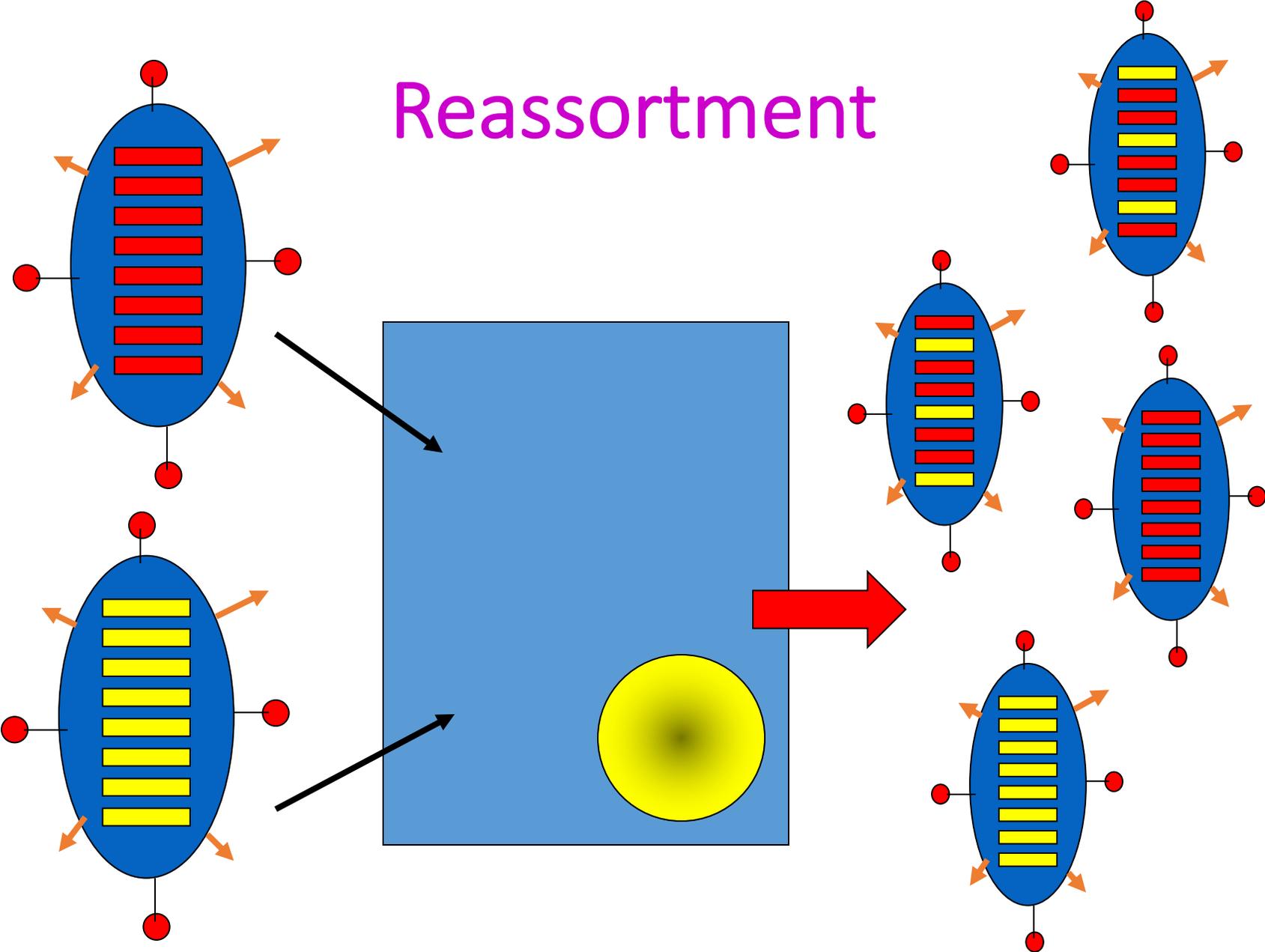


- Reassortment and antigenic shift
- Complete change of H molecule meaning no protection by old vaccines.
- Shift occurs by a) gene reassortment, b) change of species specificity

a) Gene reassortment

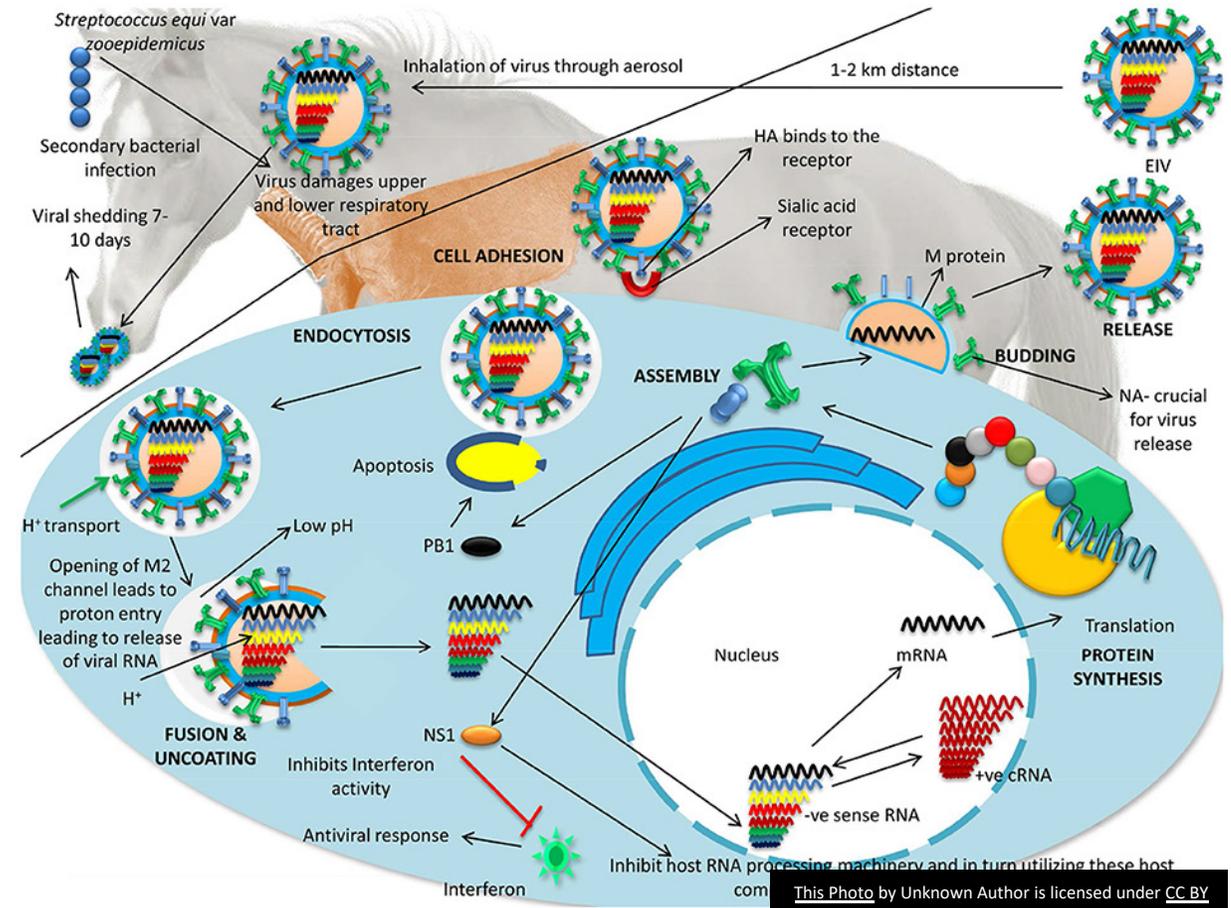
Pigs become infected with duck virus and human virus at the same time, eg on a chinese commune where all 3 species live close together. Some virus reassorts its RNA segments in the pig respiratory epithelial cells to produce a new virus with a duck H gene for attachment and a 7 human genes for virus growth. This new virus will infect vaccinated humans because it has a brand new subtype of H.

Reassortment



Pathogenesis

- Once the virus enters the organism, Aerosol virus infects the ciliated epithelium of the nasal mucosa and then may extend to the bronchioles with resulting epithelial cell necrosis, which manifests as bronchiolitis and serous exudation
- The virus spreads to the respiratory tract in 2-4 days. Rhinitis occurs.
- Histopathologically, cell infiltration in bronchial regions and thickening in alveolar walls are seen.



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Clinical Signs

A harsh dry cough follows an incubation period of 1-3 days when the horse also develops pyrexia, depression, loss of appetite, enlarged submandibular lymph nodes, muscle pain and weakness.

Secondary bacterial infection follows defective mucociliary transport.

While most animals recover in two weeks, the cough may continue longer and it may take as much as six months for some horses to regain their full ability. If animals are not rested adequately, the clinical course is prolonged.

A fatal bronchopneumonia is more likely if horses continue to be exercised.

Clinical Signs

- Type 2 cause more severe infections.
- In some cases, there is a cough that does not heal (due to the viral persistence) (two-year-old-caugh).

EQUINE INFLUENZA CLINICAL SIGNS

Like humans who are sick with the flu, horses with equine influenza (EI) just plain don't feel well. Your horse might have EI if he:

 <p>Is lethargic</p>	 <p>Has watery nasal discharge</p>
 <p>Isn't eating or has little interest in feed</p>	 <p>Has enlarged lymph nodes</p>
 <p>Is coughing</p>	 <p>Has an elevated temperature of 103-106°F</p>

Diagnosis

Virus isolation:

- Samples are taken from several horses because only a low proportion may be excreting virus. Deep nasal swabs are collected by inserting a long swab 12 inches into each nostril -
- THE SWAB IS deposited INTO 10 ML TRANSPORT MEDIUM (sterile basic salts solution containing antibiotics), transported at 4 C and frozen at -70 C.

Antigen detection:

- Directigen Flu A is a commercial antibody capture ELISA for type A antigens of nucleoprotein in swabs. It does not tell the lab which subtype is involved

Serology:

- Following clinical disease a 4 fold increase in serum antibody to H7 of equine 1 or H3 of equine 2 will occur between bleeds taken during the acute and convalescent phase (2 weeks later). This antibody can be detected by haemagglutination inhibition (HI) and will say whether virus is equine 1 or 2.



Vaccination



Treatment

- Treatment is mainly symptomatic and antibiotics like penicillin G or trimethoprim/sulfonamide are administered to prevent from secondary bacterial infections due to *Actinobacillus* species and *Streptococcus* species. Non-steroidal anti-inflammatory drugs

Though amantadine has been tried, there are no specific antiviral drugs available in the market for the treatment of EIV

- Those who block the membrane fusion
 - Amantidine (Symmetrel)
 - Remantidine (Flumadine)
- Neuraminidase inhibitors
 - Zanamivir (Relenza)
 - Oseltamivir (Tamiflu)





Prevention and Control

- Isolate coughing horses to minimise spread and use disposable syringes when treating them.
- *Prophylaxis* is by vaccination.
- Vaccines combination of A/Equine 1 (H7N7) ve A/Equine 2 (H3N8)
- Vaccination is practiced in most countries. However, due to the variability of the strains of virus in circulation, and the difficulty in matching the vaccine strain to the strains of virus in circulation, vaccination does not always prevent infection although it can reduce the severity of the disease and speed recovery times.

Single vaccination provides protection for 2-3 months. The second vaccination should be done again after 6-9 months.

Prevention

- Movement control and isolation of infected horses.
- The virus is easily killed by common disinfectants, so thorough cleaning and disinfection is part of biosecurity measures.
- Since the disease is most often introduced by an infected animal, isolation of new entries to a farm or stable is paramount to preventing the introduction of disease to a premise.



