



Tehran University
of Medical Sciences

School of Public Health

National Center of Excellence
for Public Health Education



دانشگاه علوم پزشکی و
خدمات بهداشتی درمانی تهران
دانشکده بهداشت

قطب علمی آموزش
علوم بهداشتی کشور

Influenza Virology

Dr Jila Yavarian

MD, PhD of Virology
National Influenza Center
School of Public Health
Tehran University of Medical Sciences

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Influenza morbidity & mortality



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Deaths: 250,000 - 500,000 annually except during SARS-CoV2 pandemics

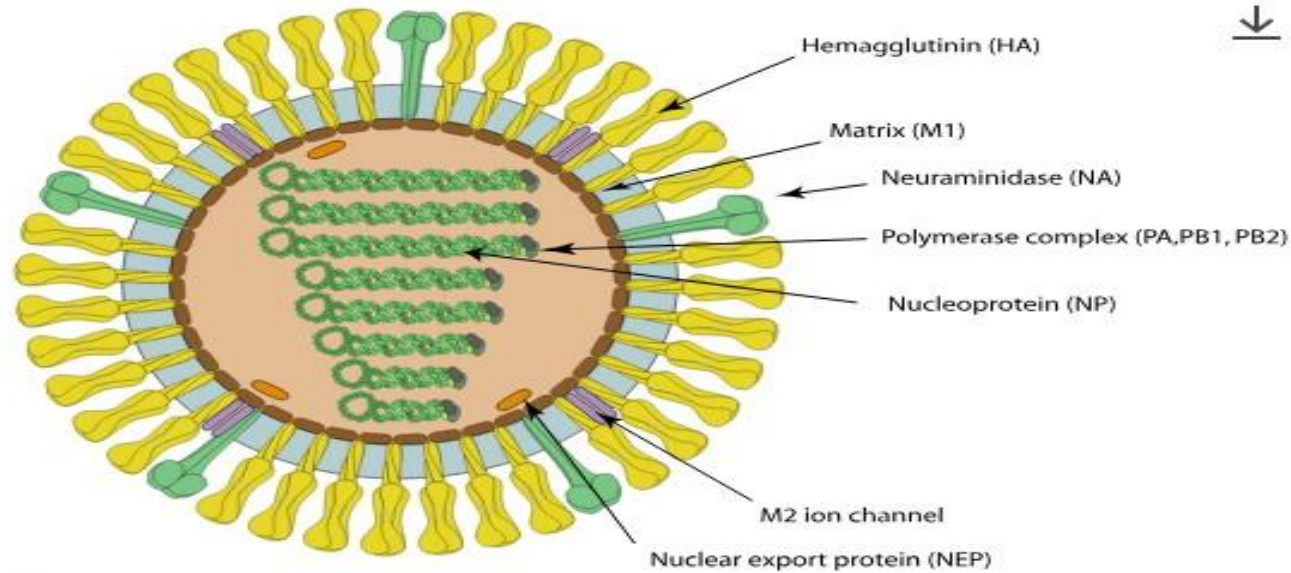
Hospitalizations: 3 - 5 million

Affected cases

Influenza is an important global public health concern.

Influenza viruses...

VIRION

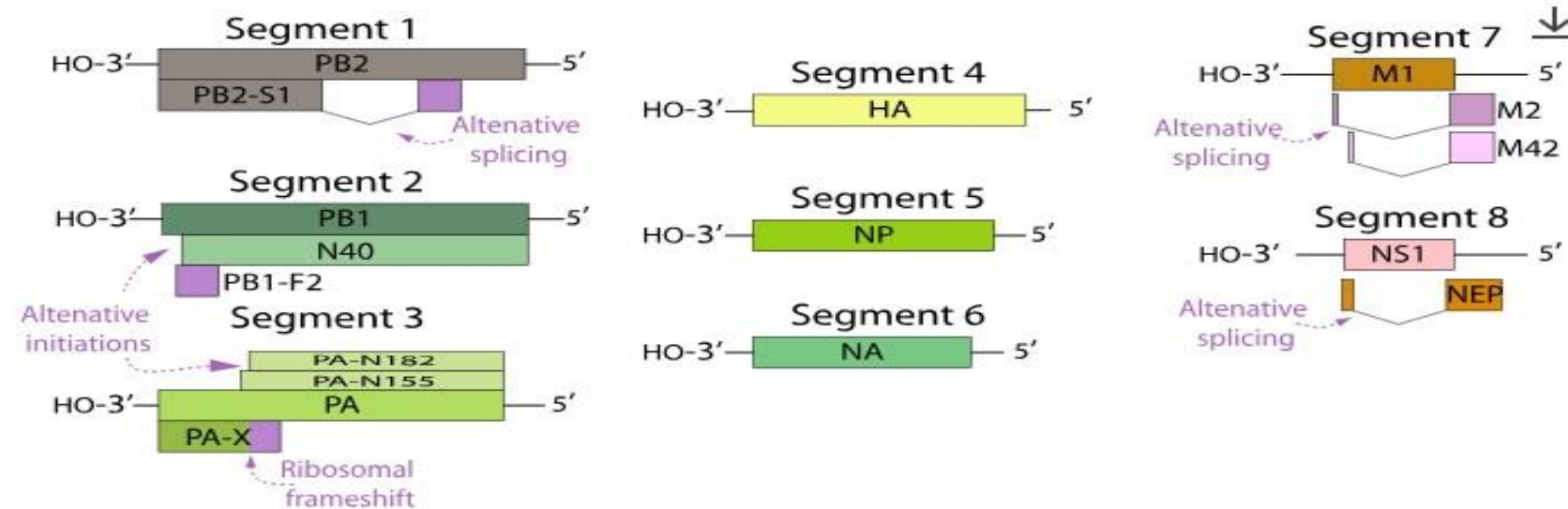


PDBBe
Protein Data Bank in Europe

Molecular biology

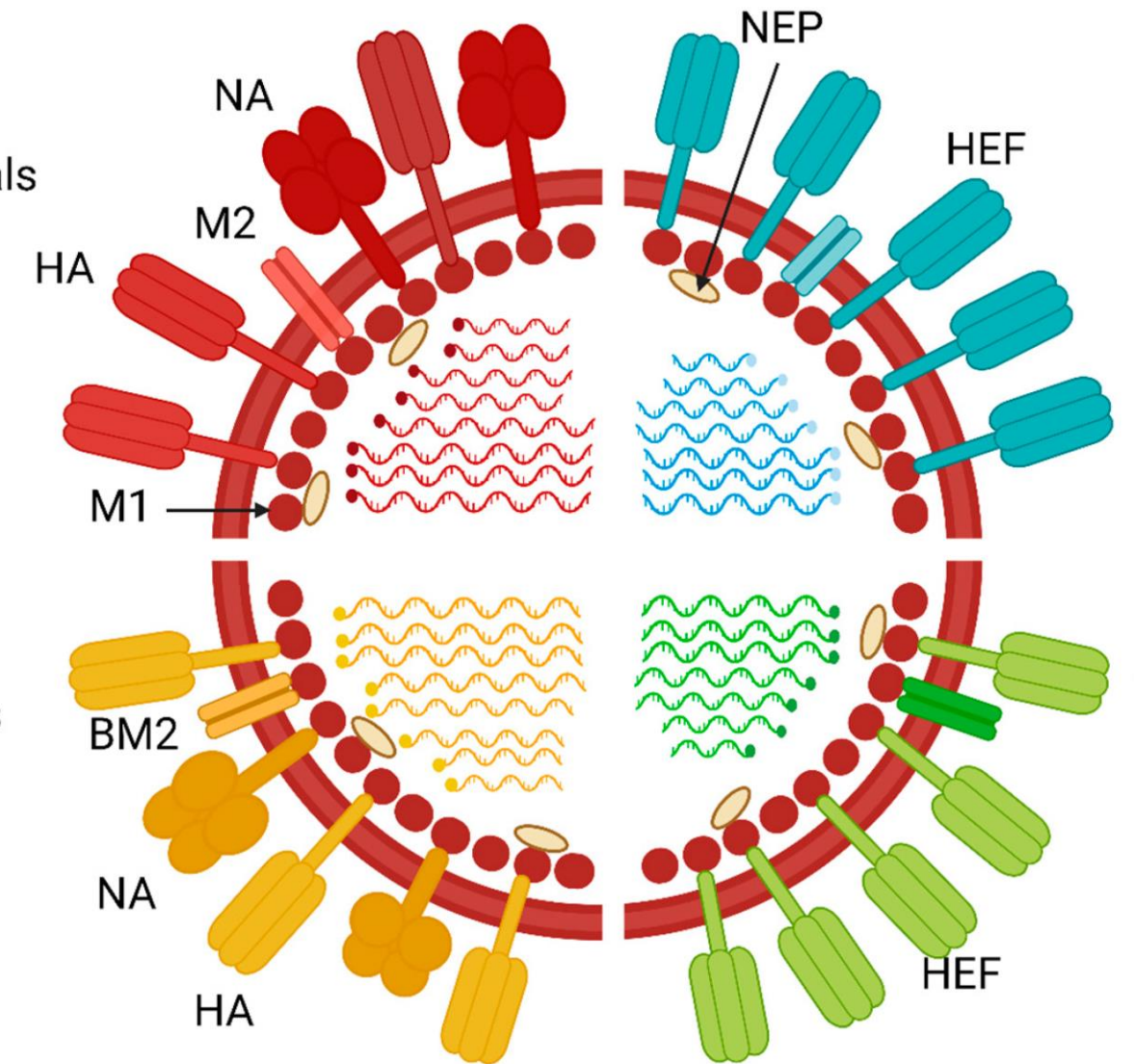
Enveloped. Usually rounded but can be filamentous. The virions are 80-120 nm in diameter.

GENOME



Google images

A
Mammals
Birds



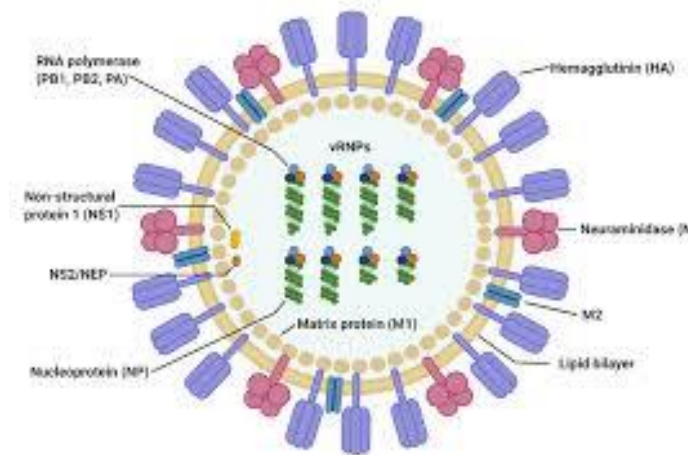
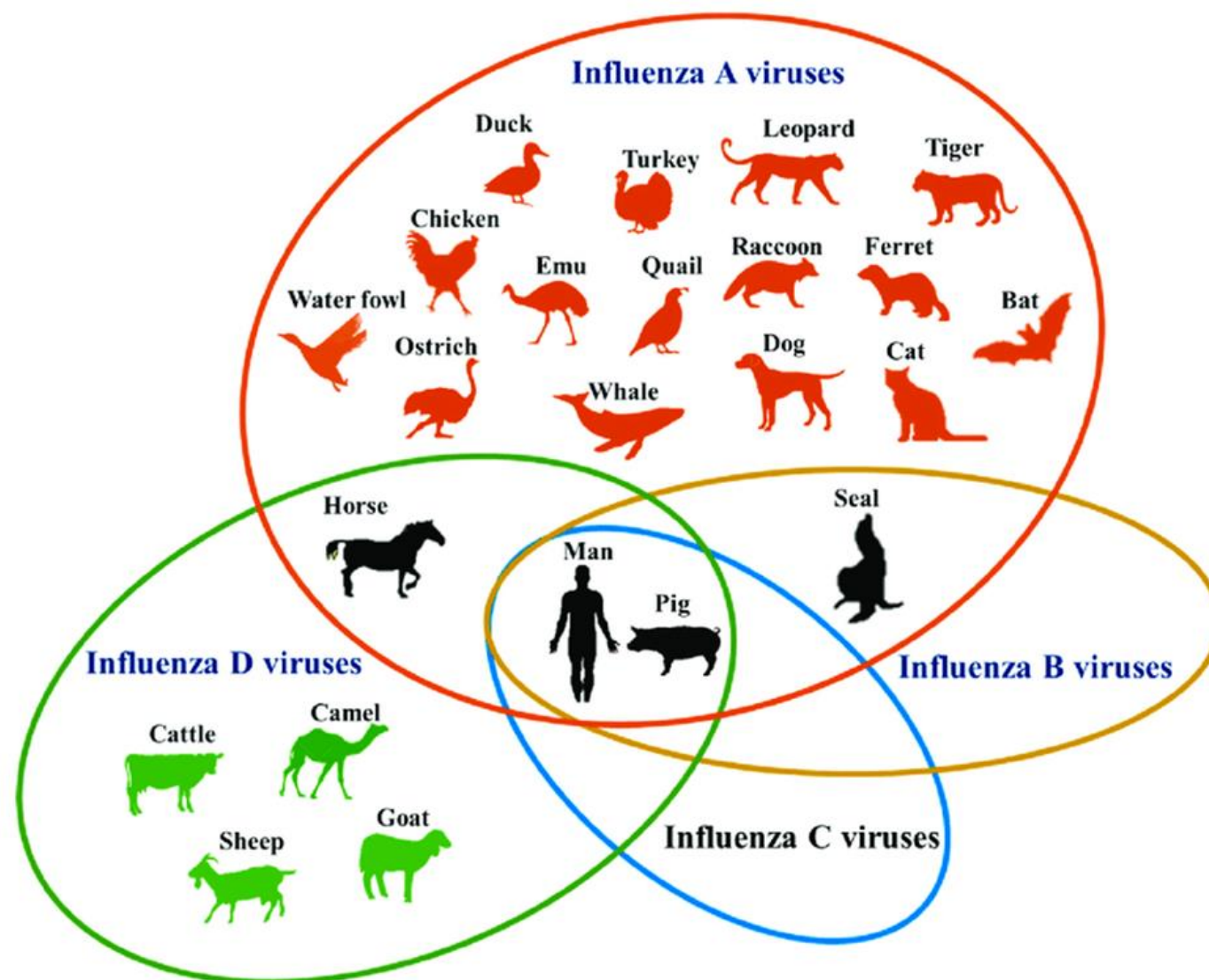
C
Humans
Pigs

B
Humans
Pigs
Seals

D
Cattle
Pigs
Camels
Horses
Sheep
Goats

Influenza A viruses

- Influenza **A** viruses are further classified into **subtypes** based on the antigenicity of their HA and NA proteins.
- 18 HA subtypes (H1–H18) & 11 NA subtypes (N1–N11) are known.



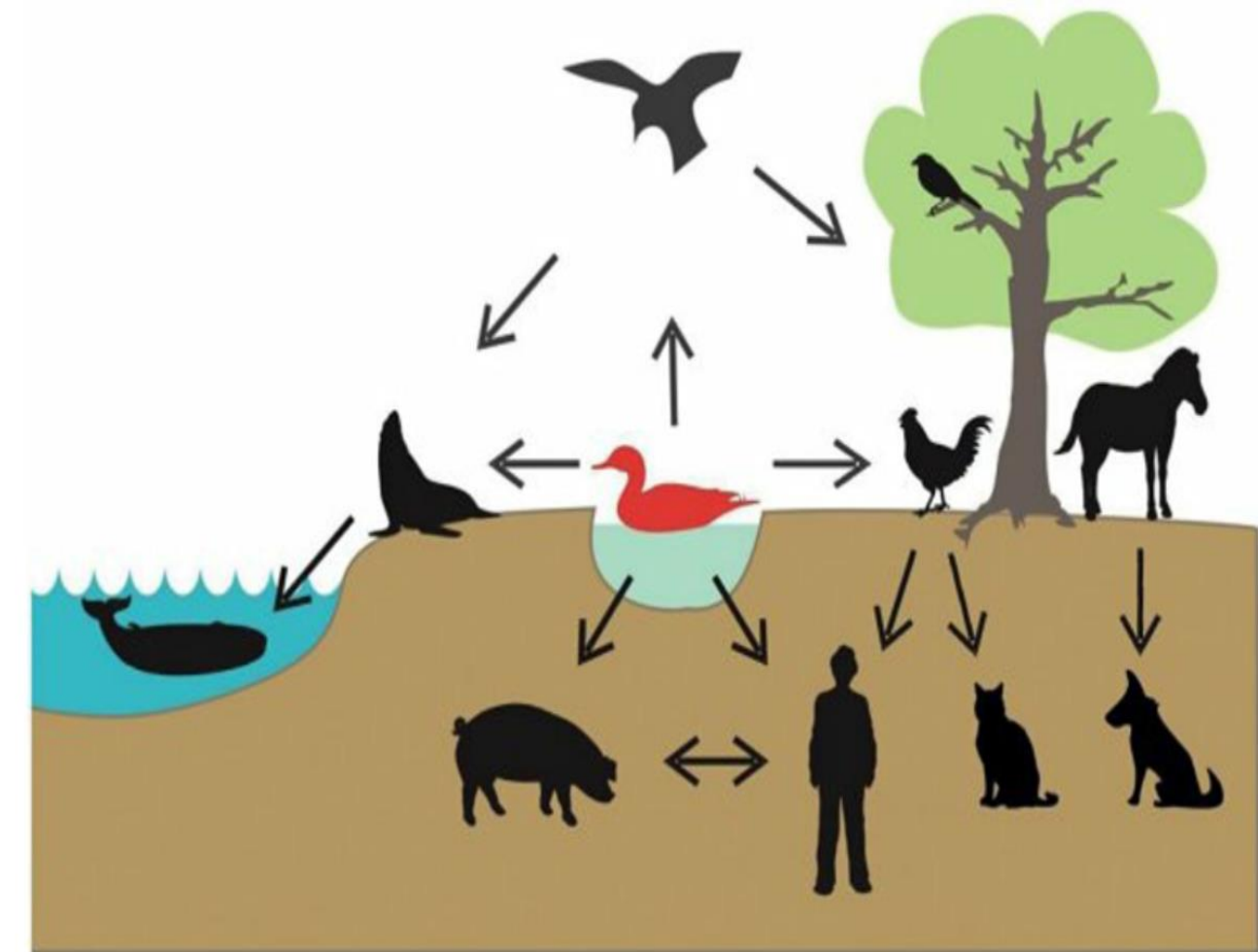
A/H1N1

A/H3N2

Victoria

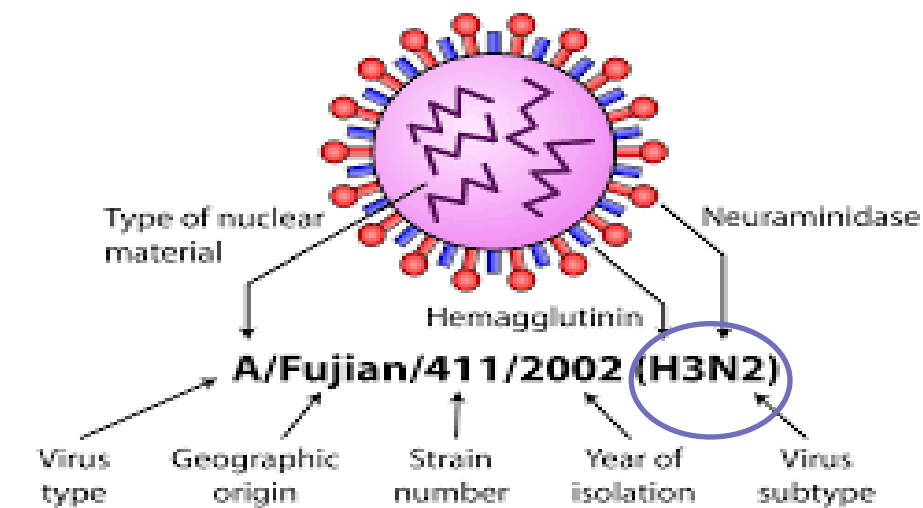
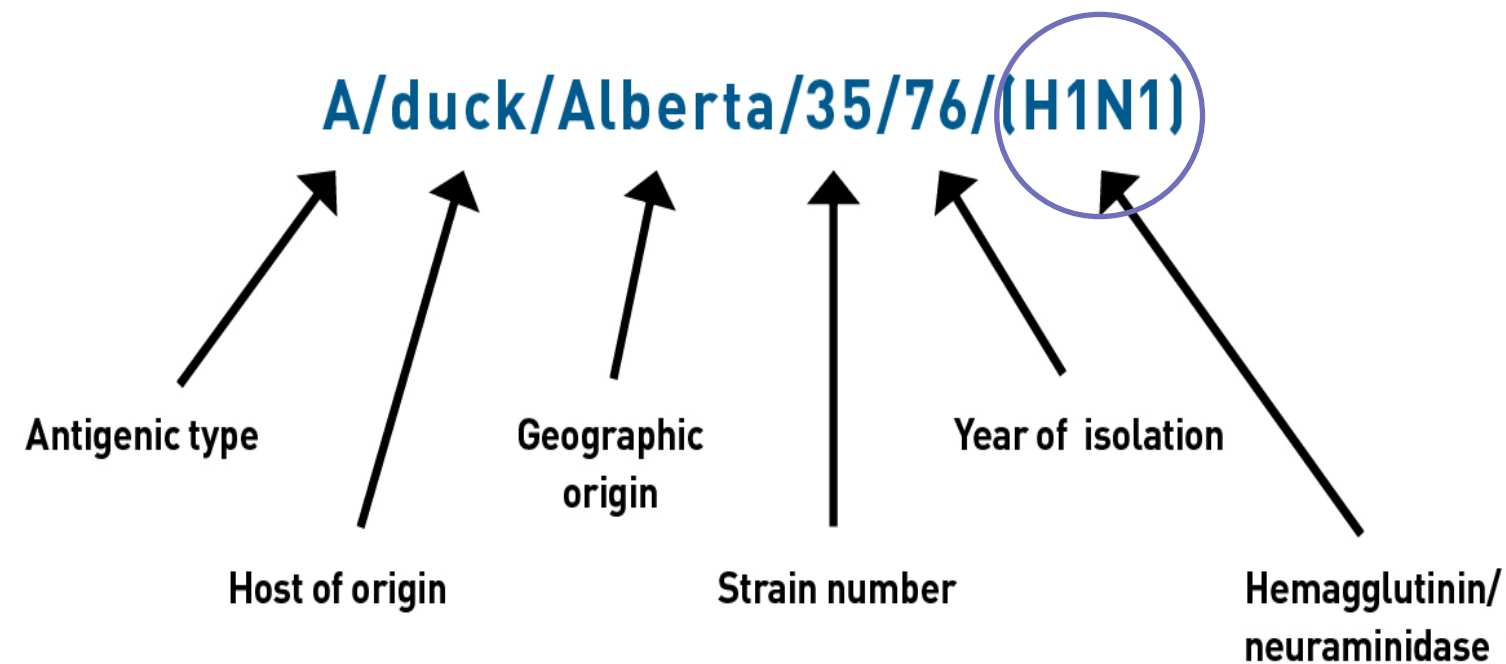
Highly or low pathogenic influenza viruses

- ✓ Based on their pathogenicity in chickens, avian influenza viruses are classified as HPAI or LPAI viruses.
- ✓ **LPAI** viruses cause mild respiratory disease, depression, and/or a decrease in egg production.
- ✓ **HPAI** viruses if it is “lethal for 6, 7, or 8 of 8, 4- to 8-week-old susceptible chickens within 10 days following inoculation.



Google images

Influenza virus nomenclature



- **For viruses isolated before 2000, the year should be given as two digits; for viruses isolated in 2000 or later, the year should be given as four digits.**

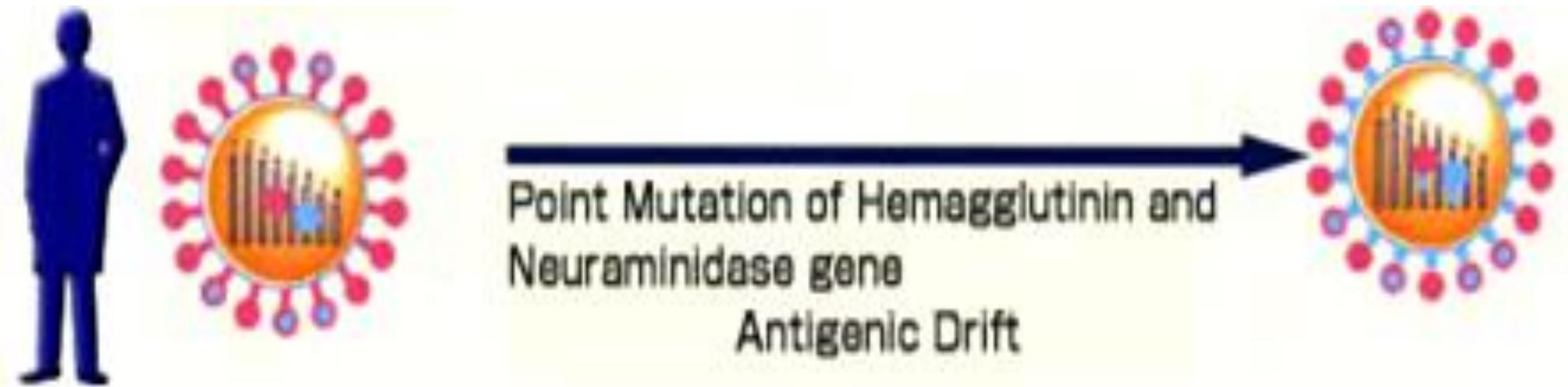
Influenza virus genome

- The specific structure of this virus allows genetic changes which can cause devastating epidemics and pandemics in humans & animals.

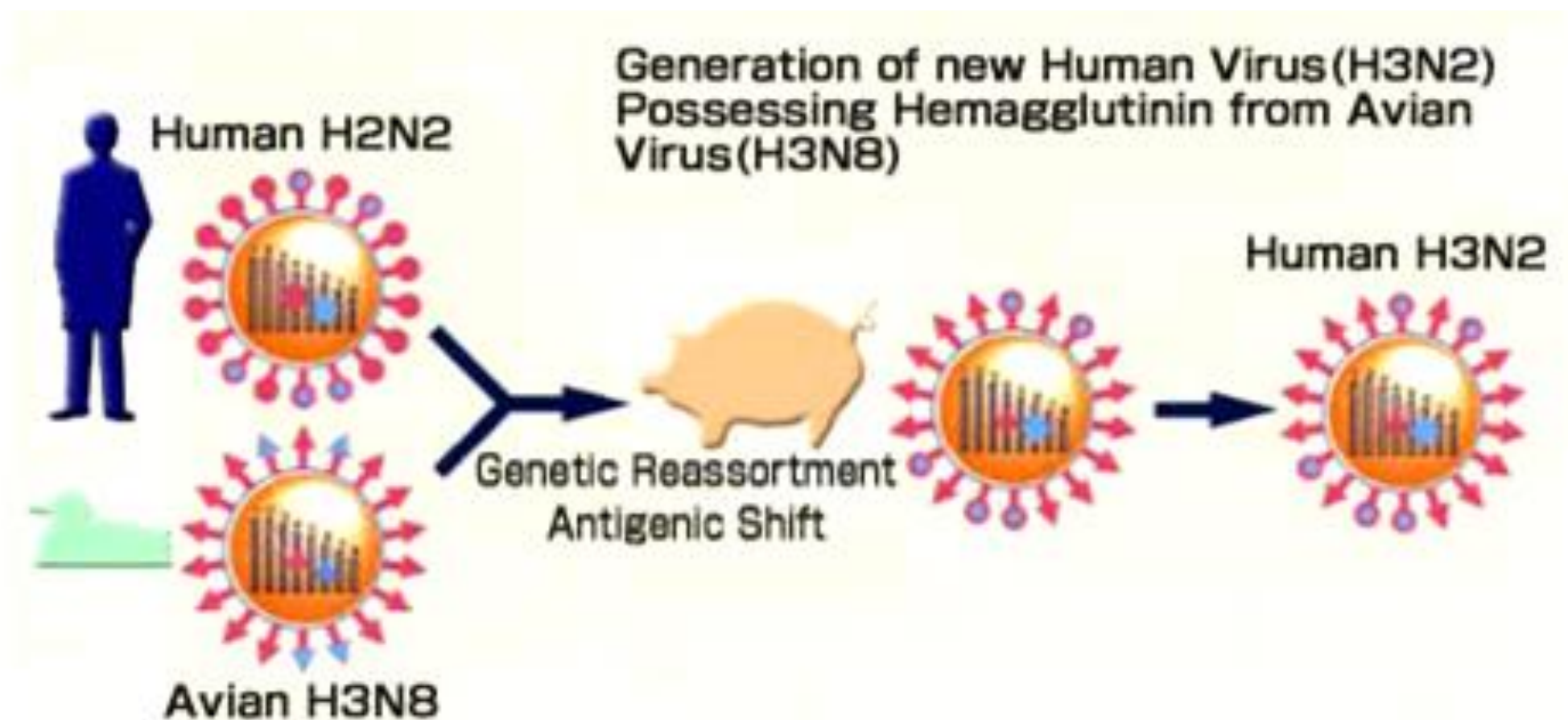
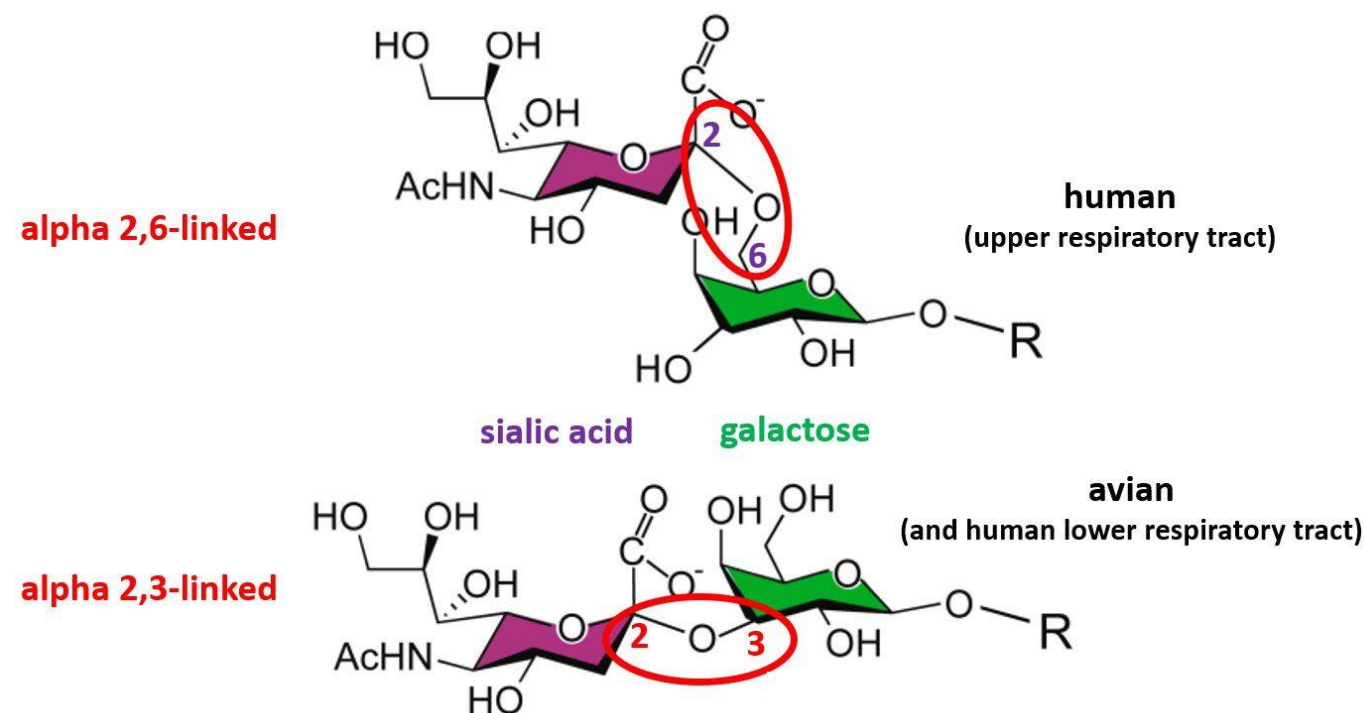
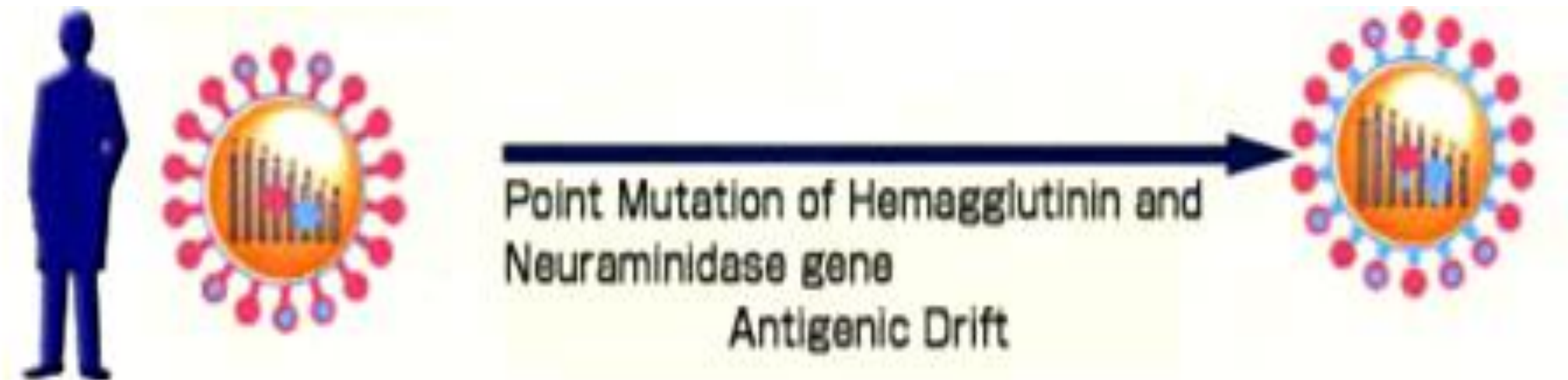


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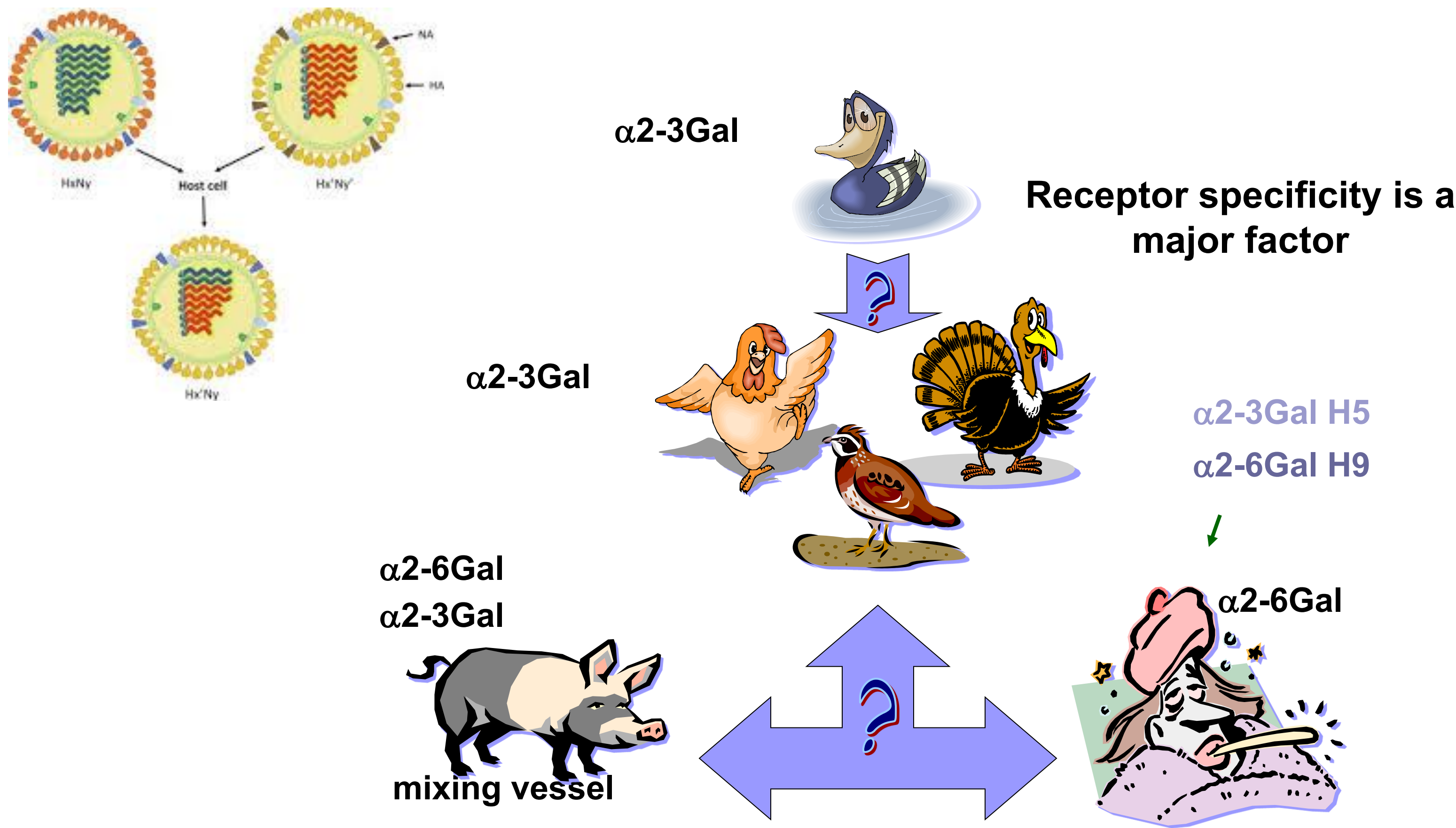
Influenza: Antigenic Drift & Shift...



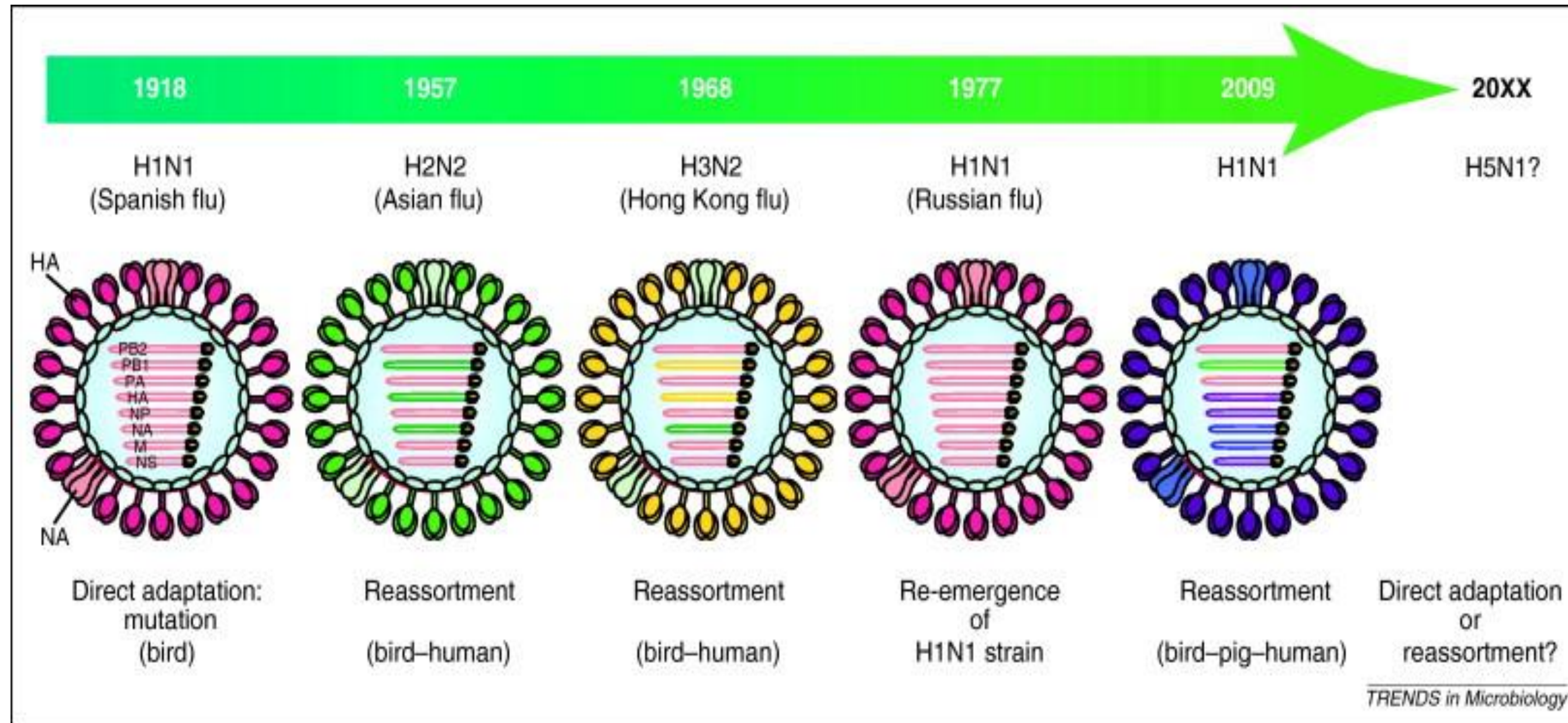
Influenza: Antigenic Drift & Shift



Molecular basis for interspecies transmission and pathogenesis.



Influenza Pandemics



Google images



Avian influenza...

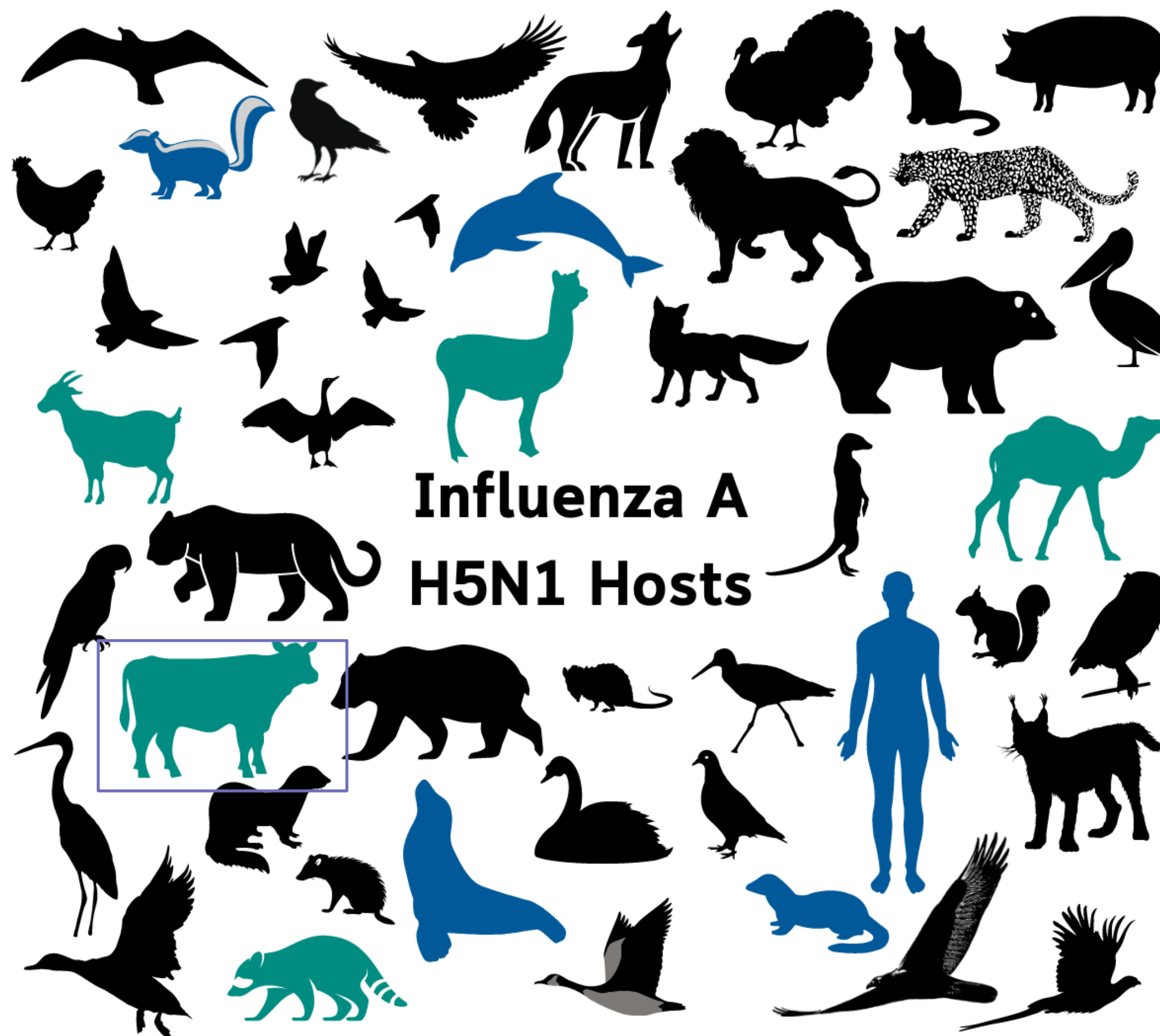
Direct human infection by an avian influenza A(H5N1) virus was first recognized during the 1997 outbreak in Hong Kong.

Subsequently, human infections with avian strains of the H9 and H7 subtypes have been further documented.

Avian influenza

Since 1997, a total of **976** sporadic human A(H5N1) cases have been reported from **24** countries, caused by different HPAI A(H5N1) virus clades, with a case fatality proportion of about 50%.

Human A(H5N1) cases peaked in **2006** (115 cases, 9 countries) and **2015** (145 cases, 4 countries) primarily due to a large epidemic in **Egypt** with 136 cases.



New 2020-2023



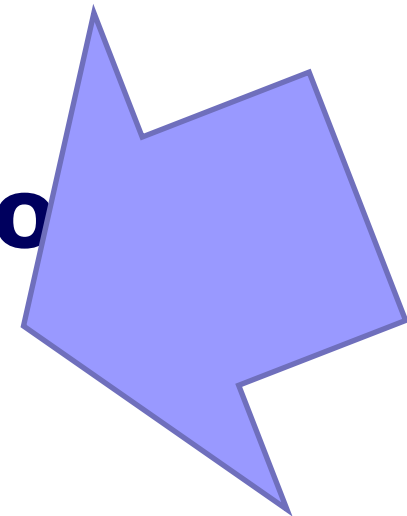
New for 2024

H5N1 Becoming a Pandemic??

For pandemic influenza to occur, three conditions must be met:

1. **A new virus** which humans are not immune emerges
2. The virus causes **severe** human illness or death in humans
3. The virus **spreads** easily from person to person worldwide

H5N1 has two of the three today.



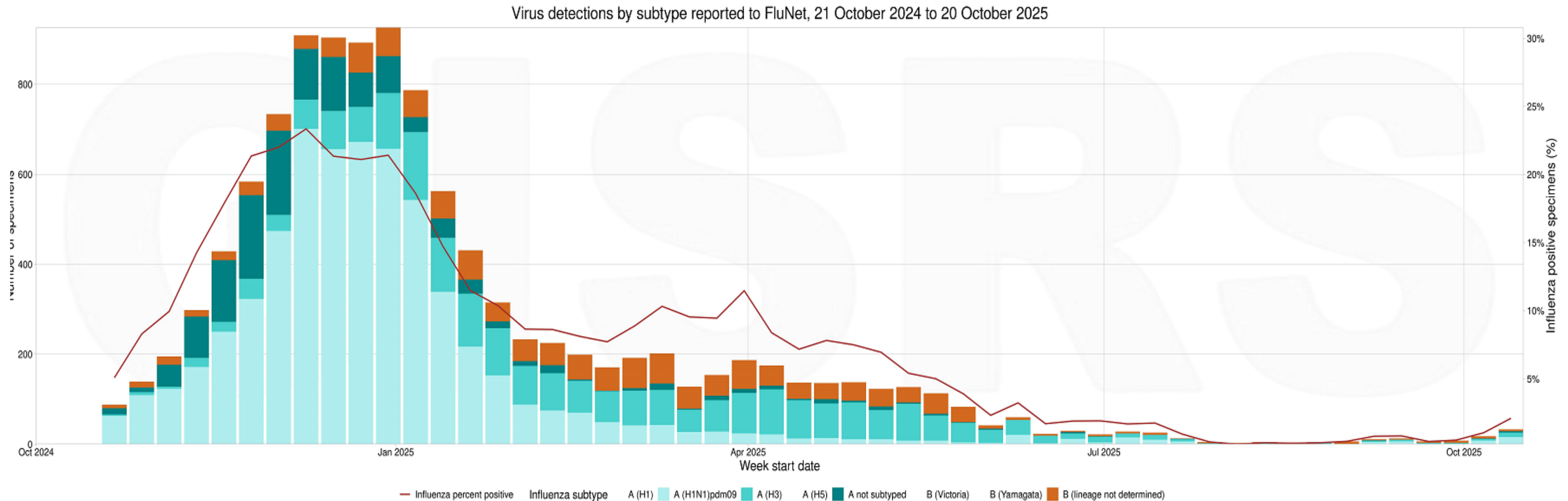
H5N1 status

Interpandemic		Pandemic alert			Pandemic
Phase 1	Phase 2	Phase 3	Phase 4	Phase 5	Phase 6
No new virus in humans	No new virus in humans	New virus in humans	Small clusters, localized	Larger clusters, localized	Increased and sustained spread in general human population
Animal viruses low risk to humans	Animal viruses low risk to humans	Little/no spread among humans	Limited spread among humans	Limited spread among humans	

↑
Current
H5N1 status



Iran influenza circulation report



The chart above is displayed for Iran (Islamic Republic of) in all sites for week start dates 21 October 2024 to 20 October 2025

<https://worldhealthorg.shinyapps.io/flunetchart/>

Take home message

- Influenza is here



- Everyone is at risk of infection and can be source of transmission
- Infection prevention practices are key to minimizing virus transmission



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