

Respiratory Viruses

RESPIRATORY TRACT INFECTIONS

(Viral agents)

- **Influenza A,B and C**
- **Rhinovirus**
- **Coronavirus**
- **Parainfluenza viruses**
- **Respiratory Syncytial viruses**
- **Adenovirus**

Viruses Associated with Respiratory Infections

Syndrome	Commonly Associated Viruses	Less Commonly Associated Viruses
Corza	Rhinoviruses, Coronaviruses	Influenza and parainfluenza viruses, enteroviruses, adenoviruses
Influenza	Influenza viruses	Parainfluenza viruses, adenoviruses
Croup	Parainfluenza viruses	Influenza virus, RSV, adenoviruses
Bronchiolitis	RSV	Influenza and parainfluenza viruses, adenoviruses
Bronchopneumonia	Influenza virus, RSV, Adenoviruses	Parainfluenza viruses, measles, VZV, CMV

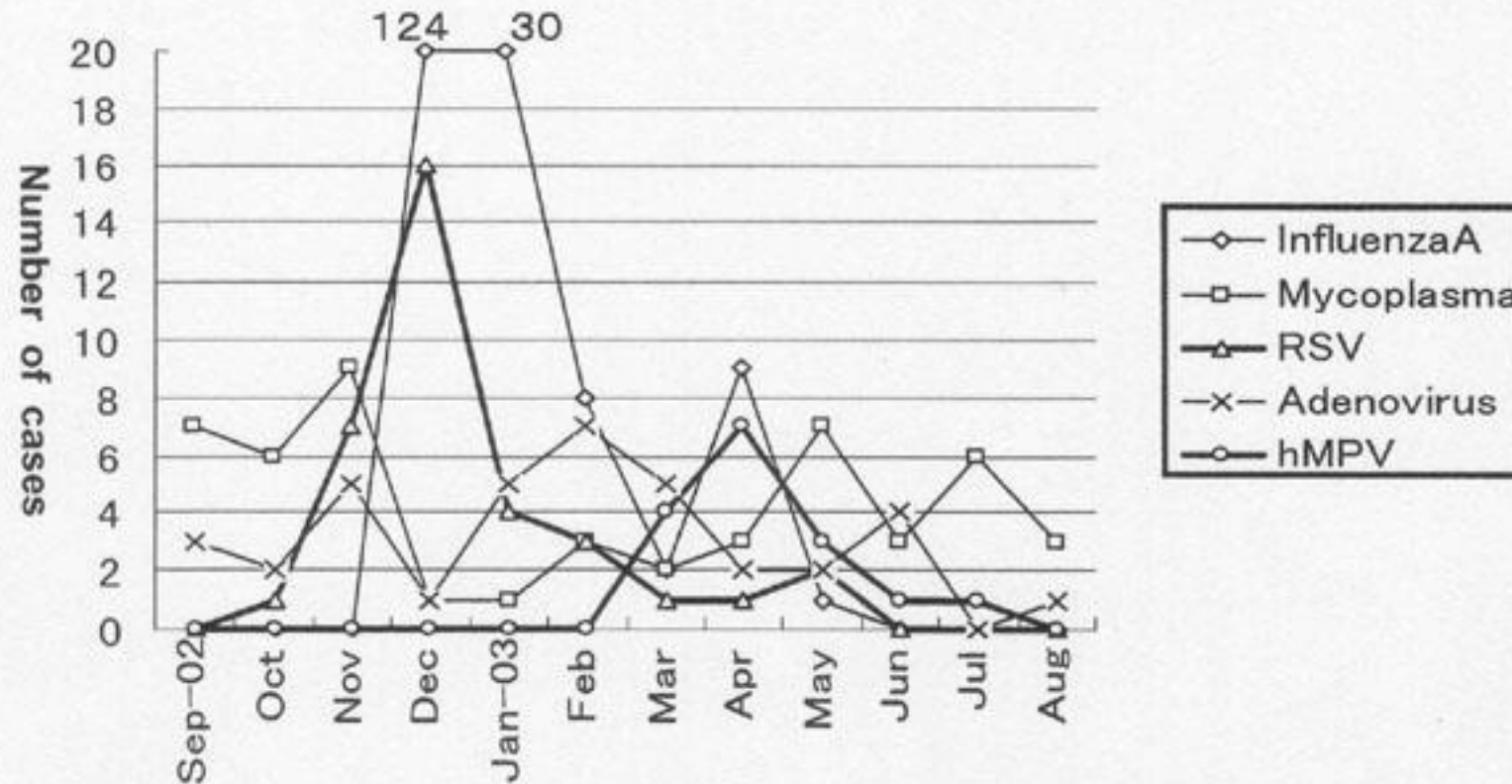


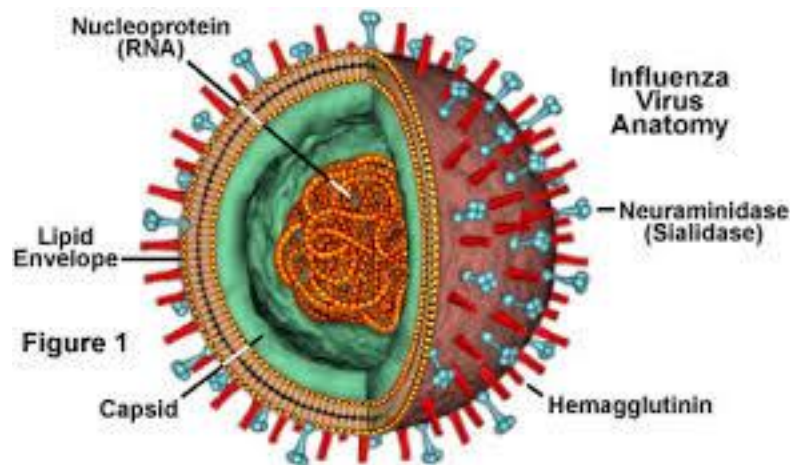
Fig. 1. Seasonal distribution of etiologic agents among outpatients with acute respiratory tract infections.

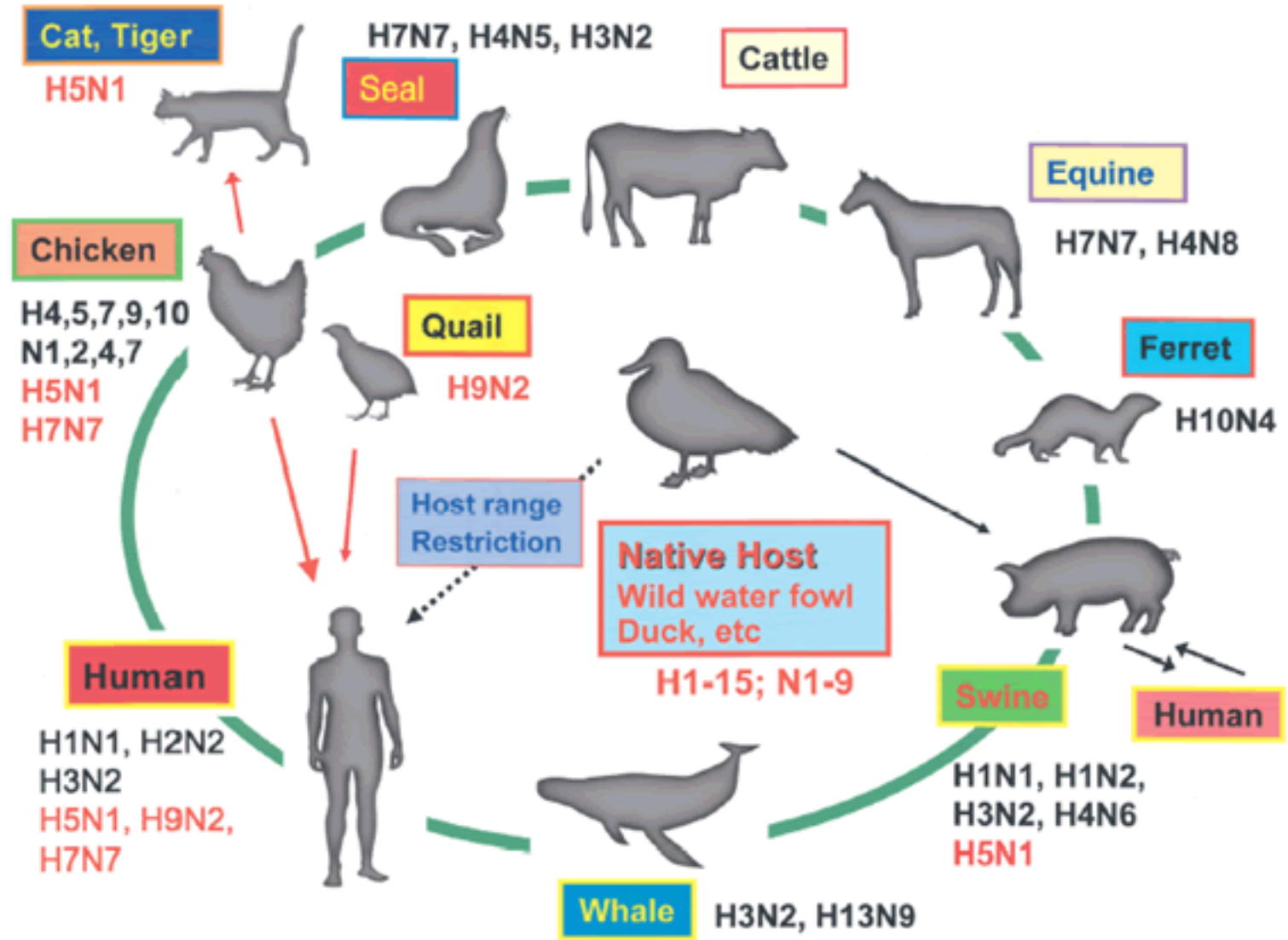
Virus antigens in the nasopharyngeal specimen of each patient were identified by Capillia Flu A, B (Nippon Becton Dickinson Co. Ltd., Tokyo) for influenza A and B viruses, the check Ad (AZWELL Inc., Osaka) for adenovirus, and the Test Pack RSV (Abbott Japan Co. Ltd., Tokyo) for RS virus. IgM antibody for *Mycoplasma pneumoniae* in the patient's serum was tested using ImmunoCard Mycoplasma (TFB Inc, Tokyo). hMPV-RNA were detected by RT-PCR as previously described (2).

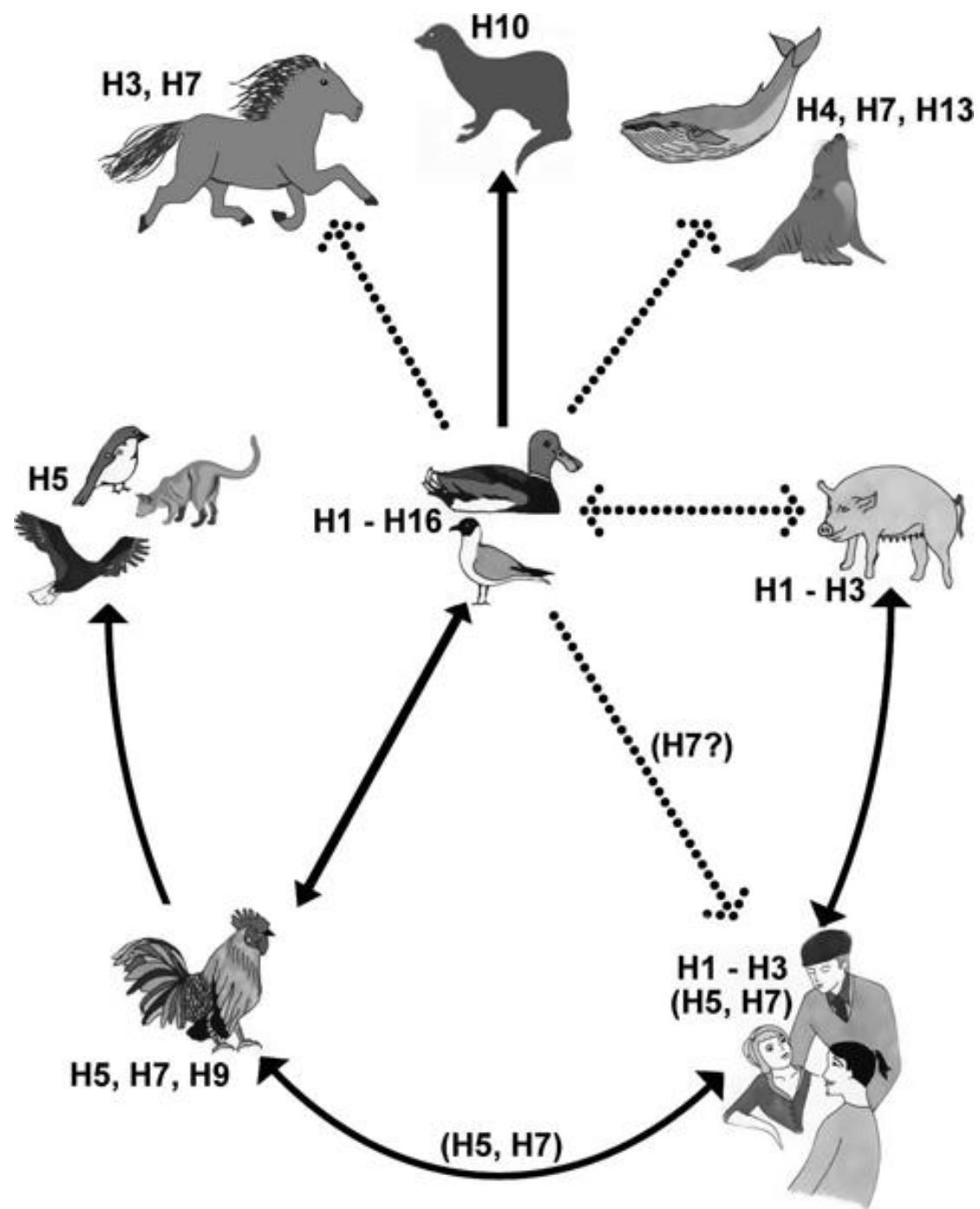
Influenza Virus



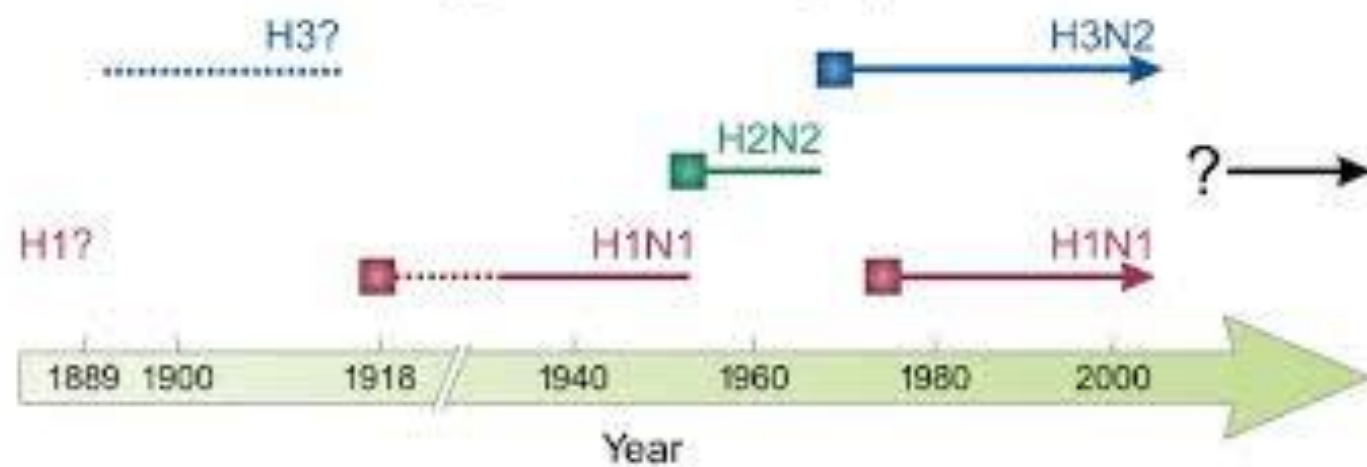
- Orthomyxoviride
- 3 types: A, B and C
- RNA/Enveloped virus
- Genome consists of 8/7 segments
- Type A undergoes antigenic shift and drift
- Type B undergoes antigenic drift only
- Type C stable





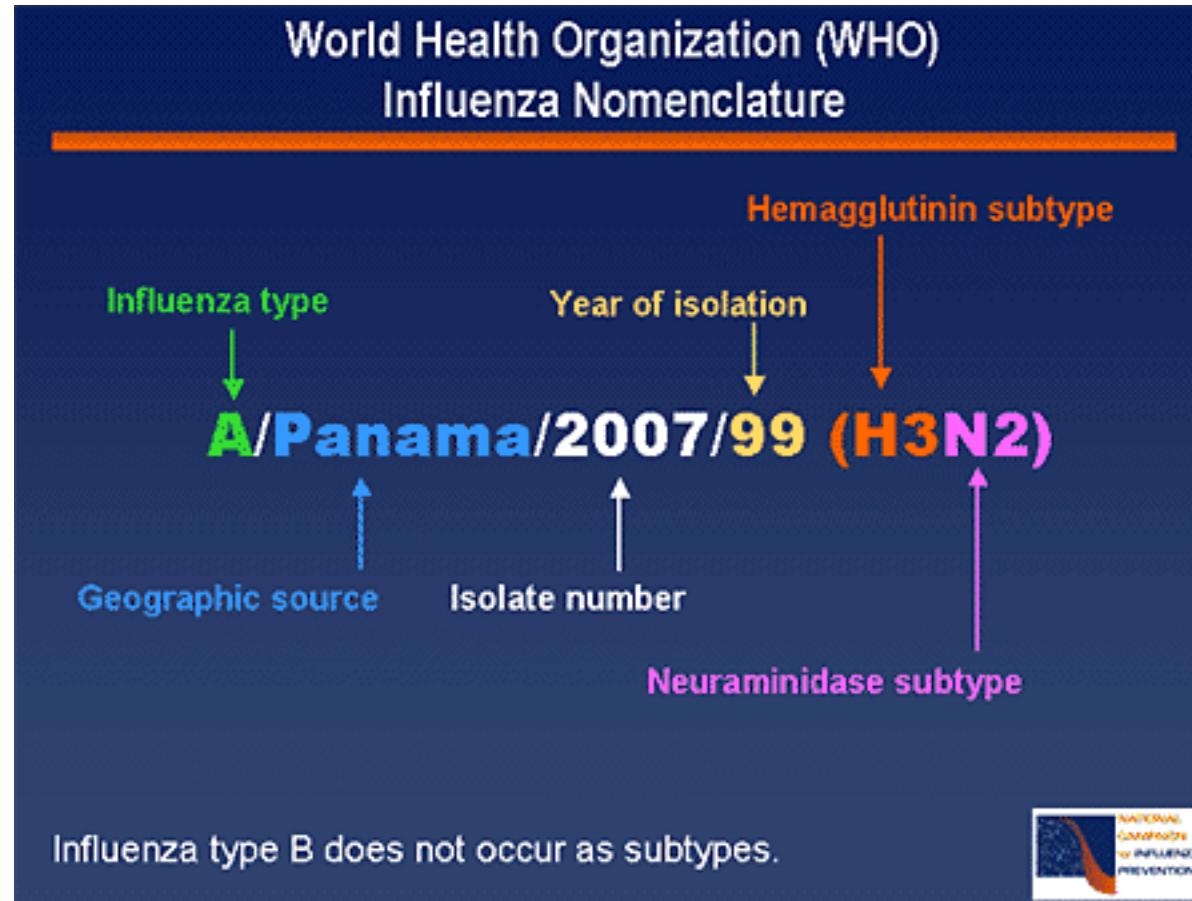


Influenza A virus subtypes in the human population



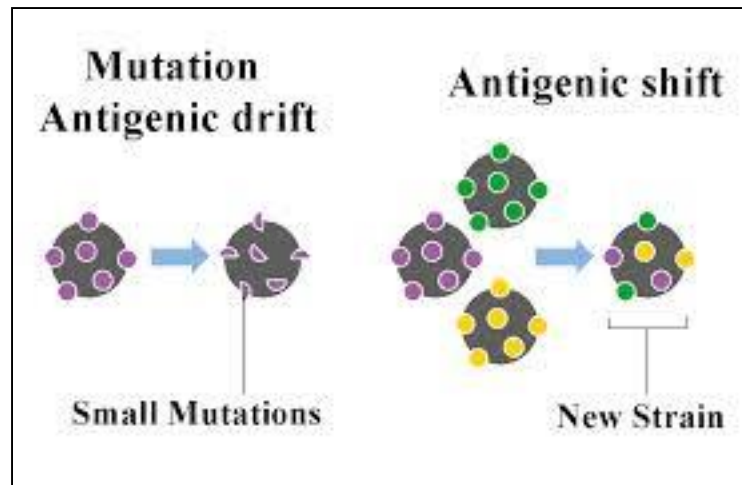
Nomenclature

(Human Influenza Virus)

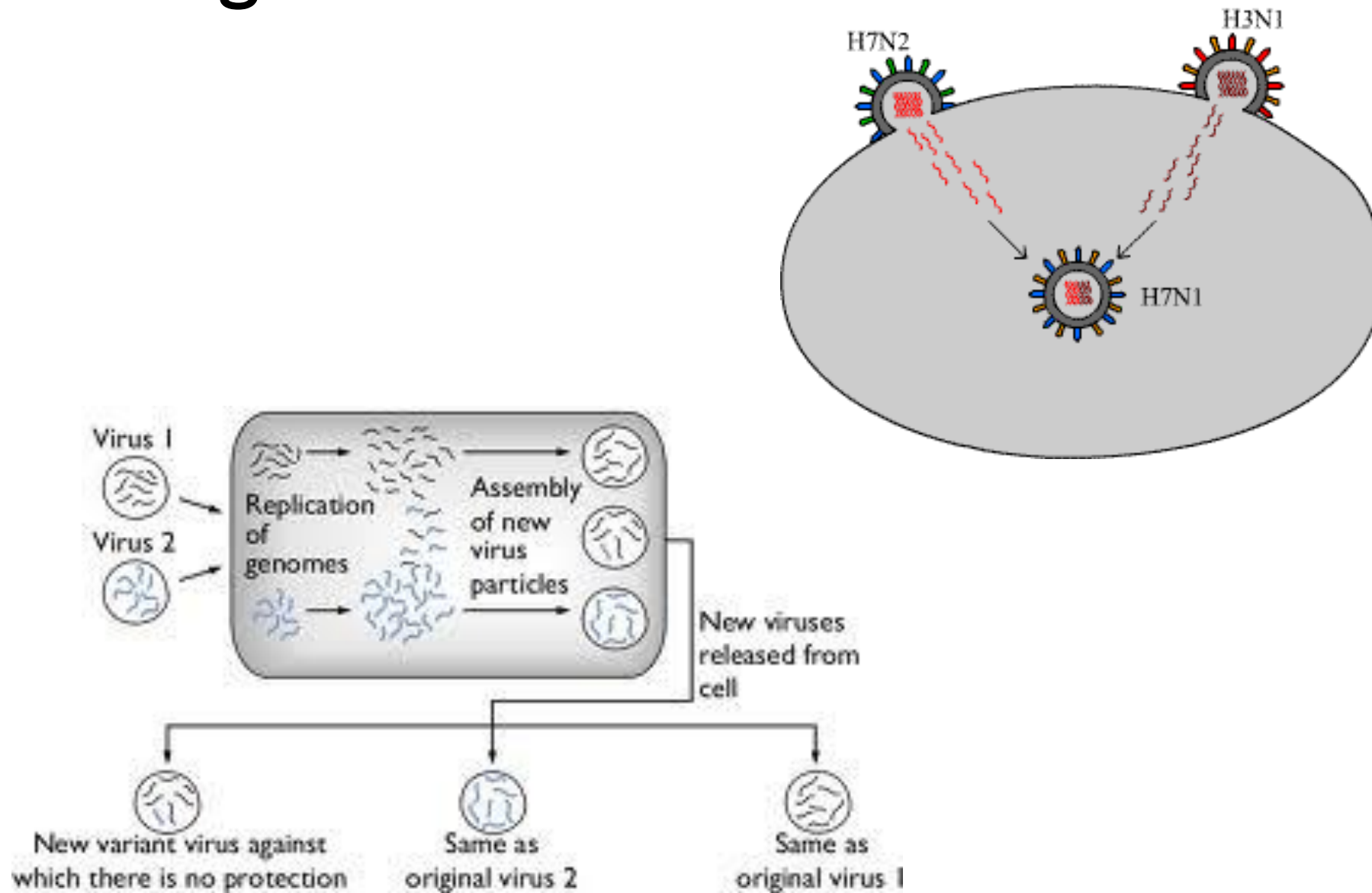


Influenza (Antigenic shift and drift)

- Haemagglutinin and neuraminidase proteins
- Antigenic shift (Occasionally- Pandemics)
- Antigenic drift (Frequently-Epidemics)
- Antigenic shifts of the haemagglutinin results in pandemics.
- Antigenic drifts in the H and N proteins result in epidemics.
- Usually causes a mild febrile illness.
- Death may result from complications such as viral/bacterial pneumonia.



Antigenic shift



Influenza virus first isolated

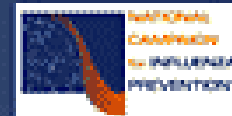
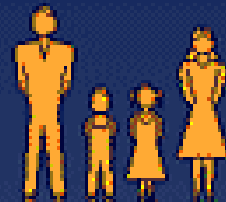
1933



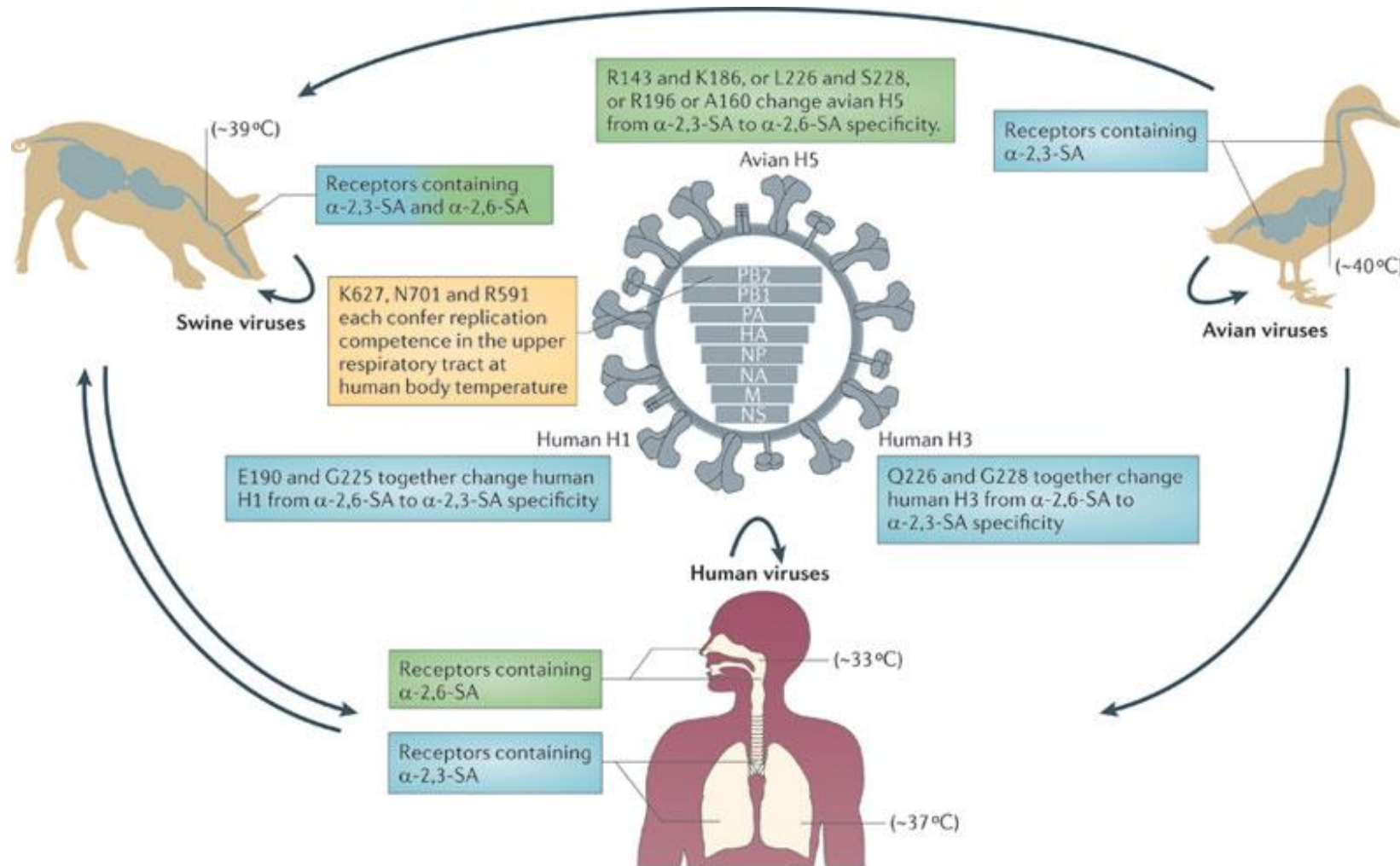
RUSSIA



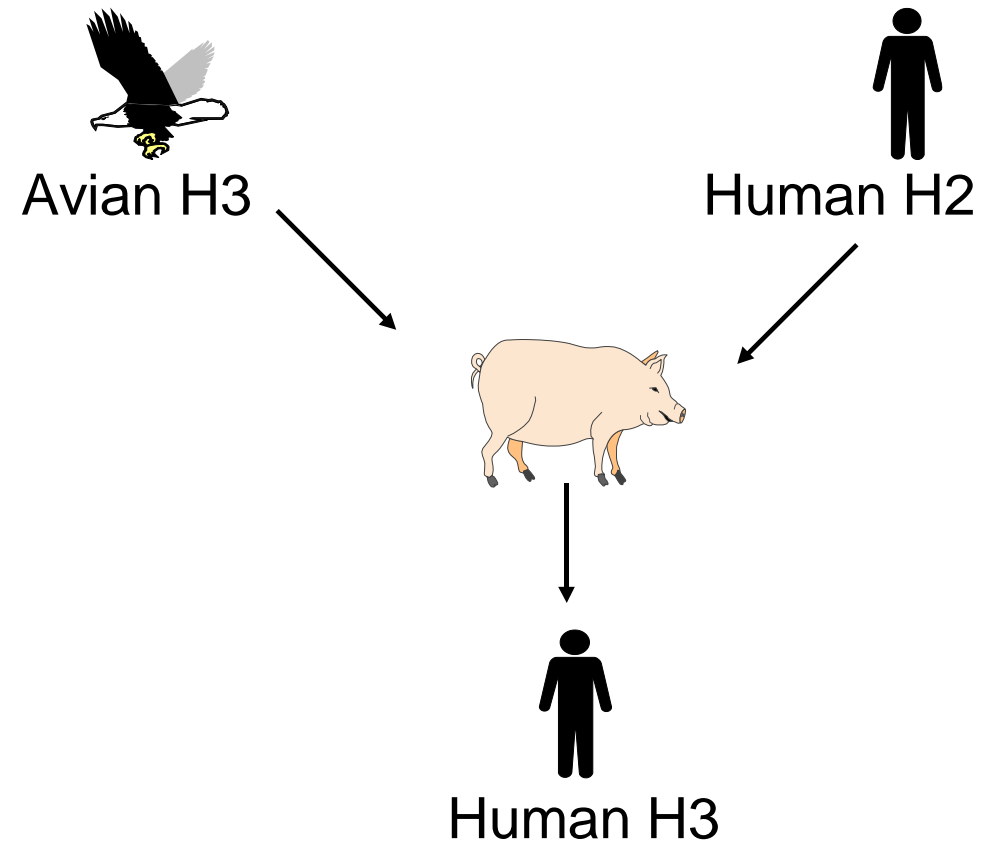
100



Receptor distribution



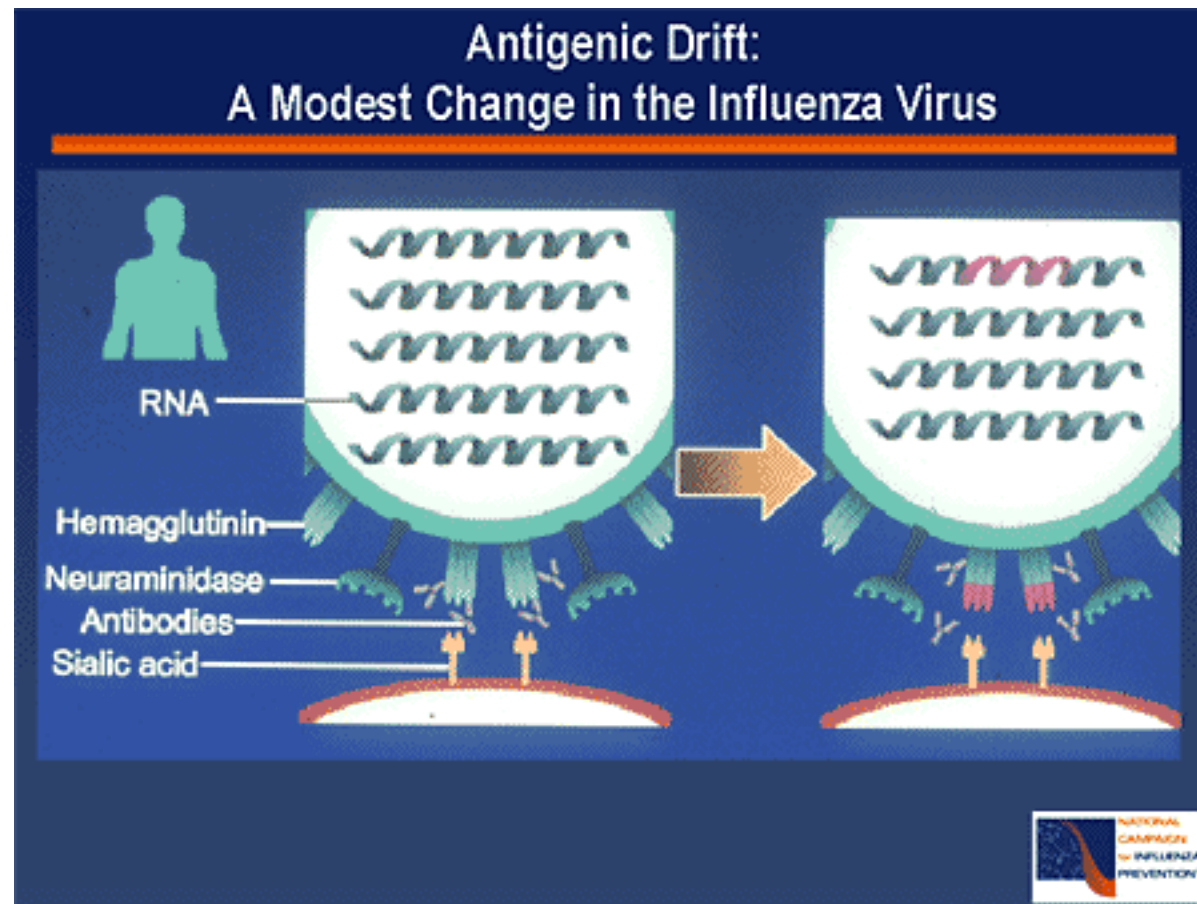
Reassortment



Past Pandemics

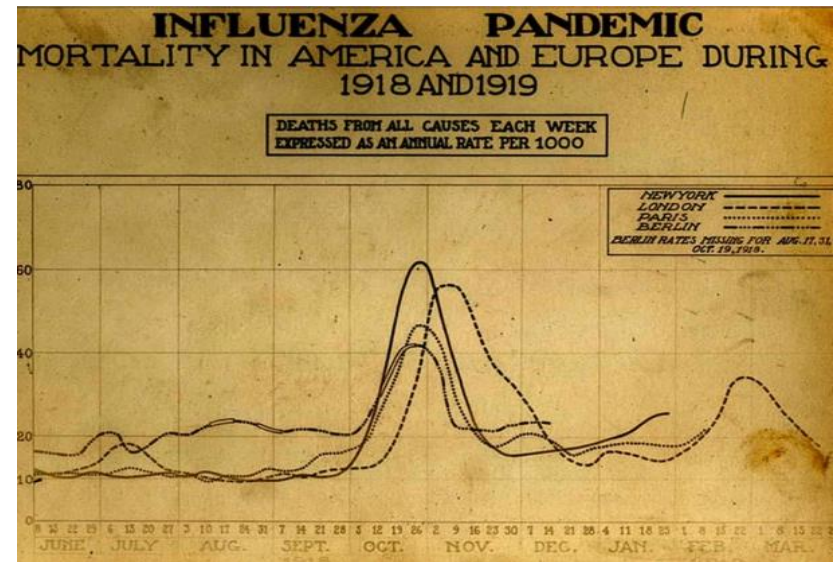
1918	H1N1	“Spanish Influenza”	20-40 million deaths
1957	H2N2	“Asian Flu”	1-2 million deaths
1968	H3N2	“Hong Kong Flu”	700,000 deaths
1977	H1N1	Re-emergence	???? pandemic
2009	H1N1	“Swine Flu	Pandemic

Antigenic drift



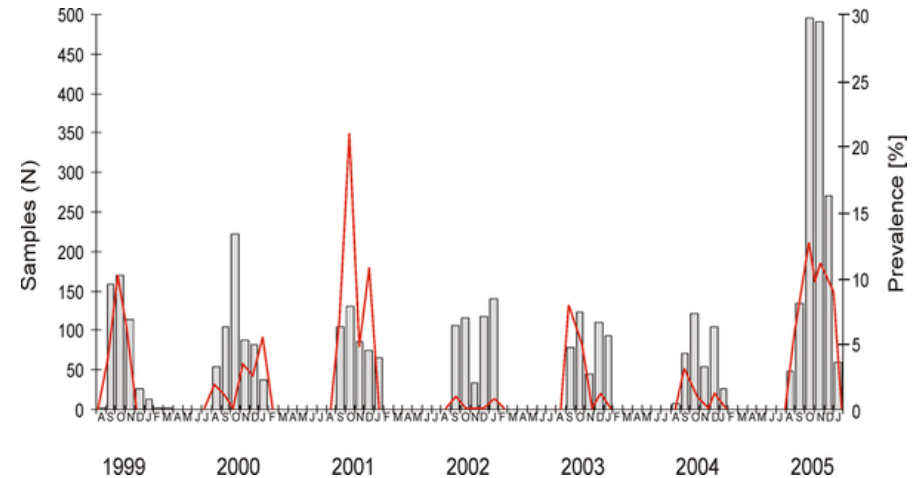
Pandemics

Influenza A pandemics arise when a virus with a new haemagglutinin subtype emerges as a result of antigenic shift. the population has no immunity against the new strain



Epidemics

Epidemics of influenza A and B arise through more minor antigenic drifts as a result of mutation



Avian Influenza

Wholly avian viruses

H5N1

- An outbreak H5N1 occurred in Hong Kong in 1997 – 18 infected, 6 died.
- The source probably from infected chickens and the outbreak was controlled by a mass slaughter of chickens
- All strains were totally avian in origin/no evidence of reassortments



H9N2

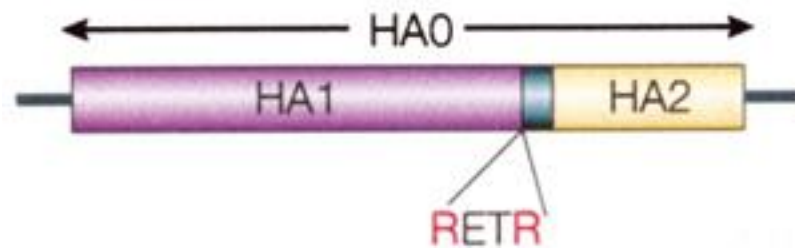
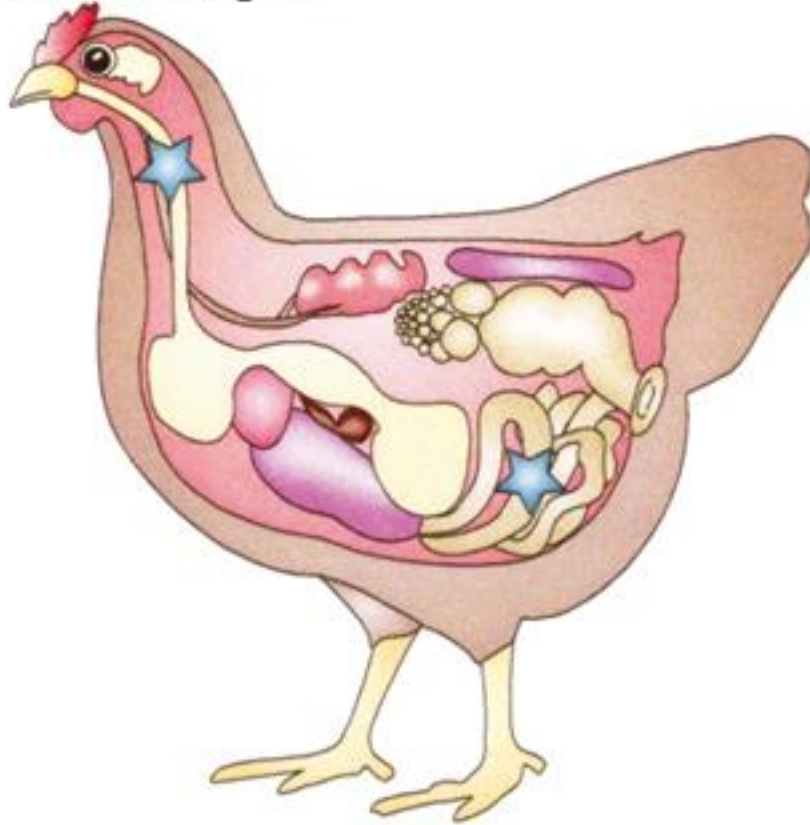
H7N7

H7N9



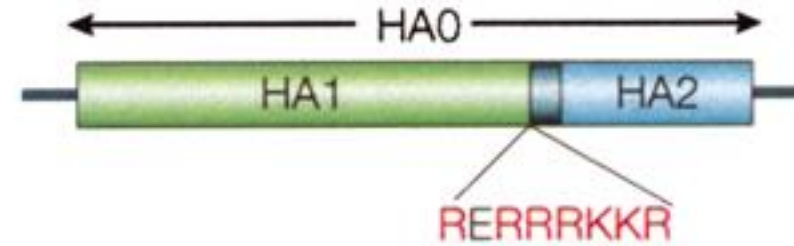
LPAI

Proteases localized in respiratory and intestinal organs

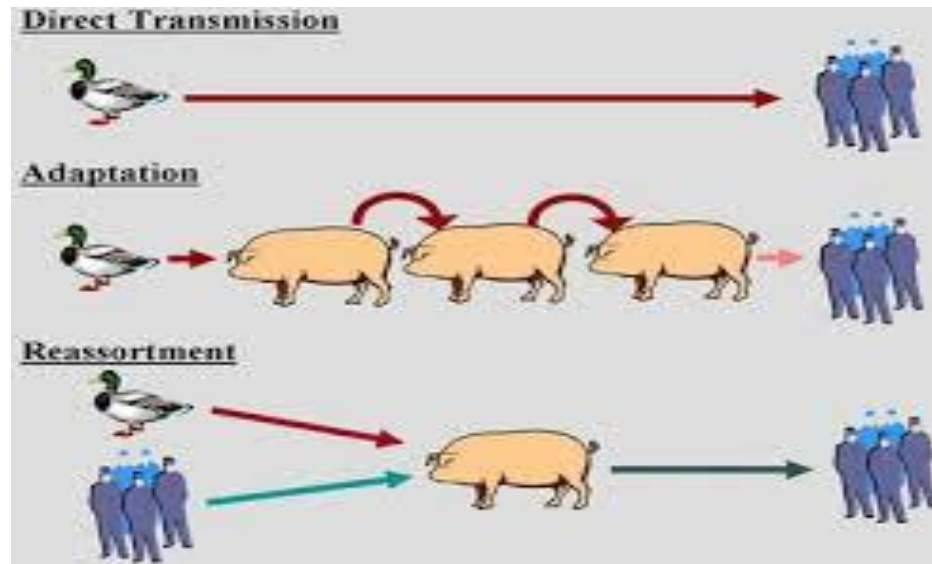


HPAI

Ubiquitous proteases



Transmission of Influenza viruses



Laboratory Diagnosis

- **Rapid Diagnosis** – nasopharyngeal aspirates, throat and nasal swabs
- **Antigen Detection** – IFT or EIA
- **Virus Isolation** - nasopharyngeal aspirates and throat swabs
- **Serology** - a retrospective diagnosis may be made by serology. HAI
- **Molecular** – RT-PCR assays give the best sensitivity and specificity

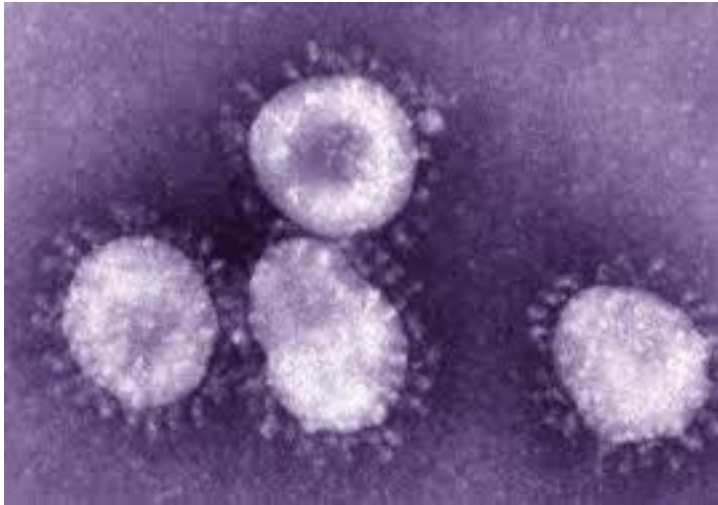
Rx

- Amantidine Required to give in early in the illness. emerges rapidly
- Rimantidine is similar to amantidine/less neurological side effects
- Ribavirin is thought to be effective against both influenza A and B
- Neuraminidase inhibitors
Highly effective and have fewer side effects than amantidine.
Oseltamivir (Tamiflu) and Zanamivir (Relenza)

Prevention

- Trivalent-one A H3N2 strain/one A H1N1 strain and one B strain
- The strains are reviewed by the WHO annually
- Debilitated and elderly individuals who are at risk of severe influenza infection ???
- Inactivated split/subunit vaccines are available against influenza A and B

Coronavirus



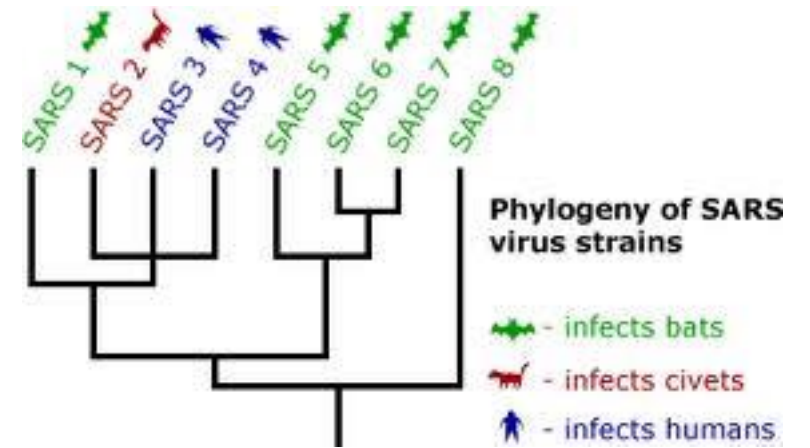
- ssRNA Virus
- Enveloped
- Pleomorphic morphology

Corona Ecology

Virus infects mammals and birds

Cause a significant percentage of all common colds in human

Infect the upper respiratory and gastrointestinal tract mammals/birds

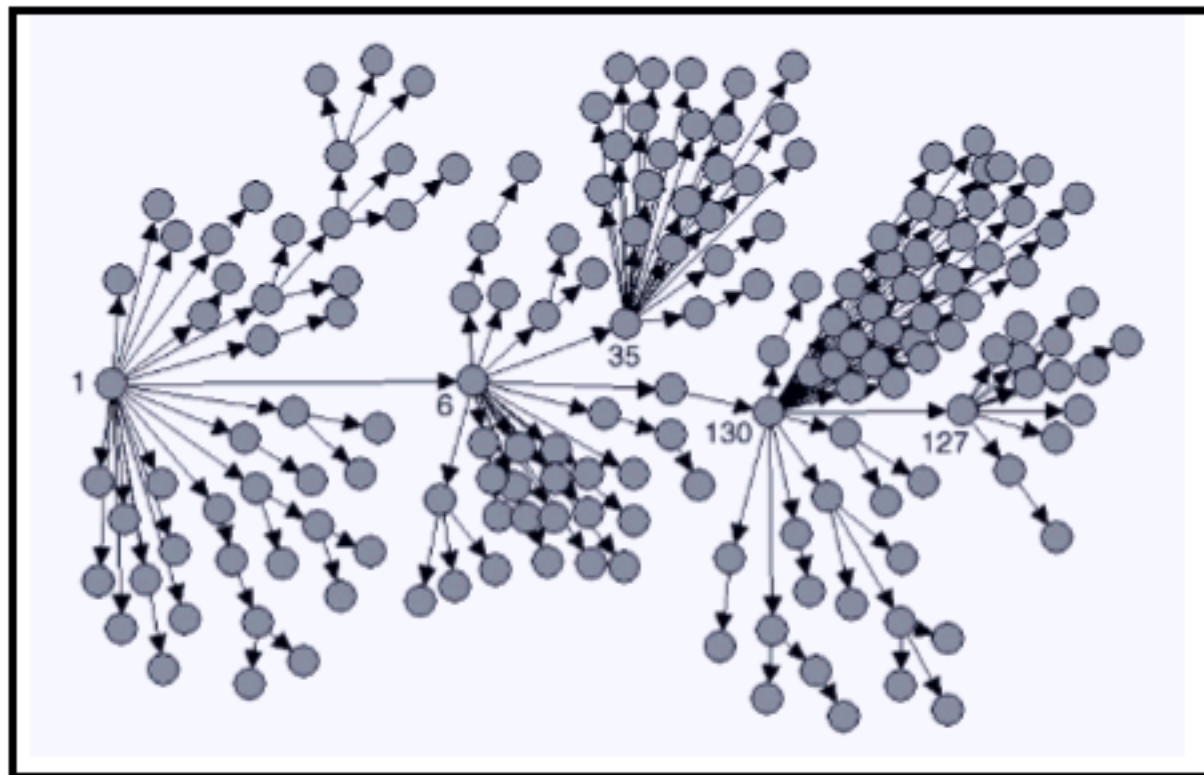


BUT??????

- In 2003 ??????
- The SARS epidemic resulted in over 8,000 infections
- 10% died



FIGURE 2. Probable cases of severe acute respiratory syndrome, by reported source of infection* — Singapore, February 25–April 30, 2003



* Patient 1 represents Case 1; Patient 6, Case 2; Patient 35, Case 3; Patient 130, Case 4; and Patient 127, Case 5. Excludes 22 cases with either no or poorly defined direct contacts or who were cases translocated to Singapore and the seven contacts of one of these cases.

Reference: Bogatti SP. Netdraw 1.0 Network Visualization Software. Harvard, Massachusetts: Analytic Technologies, 2002.

Spread from Hotel M

Reported as of March 28, 2003

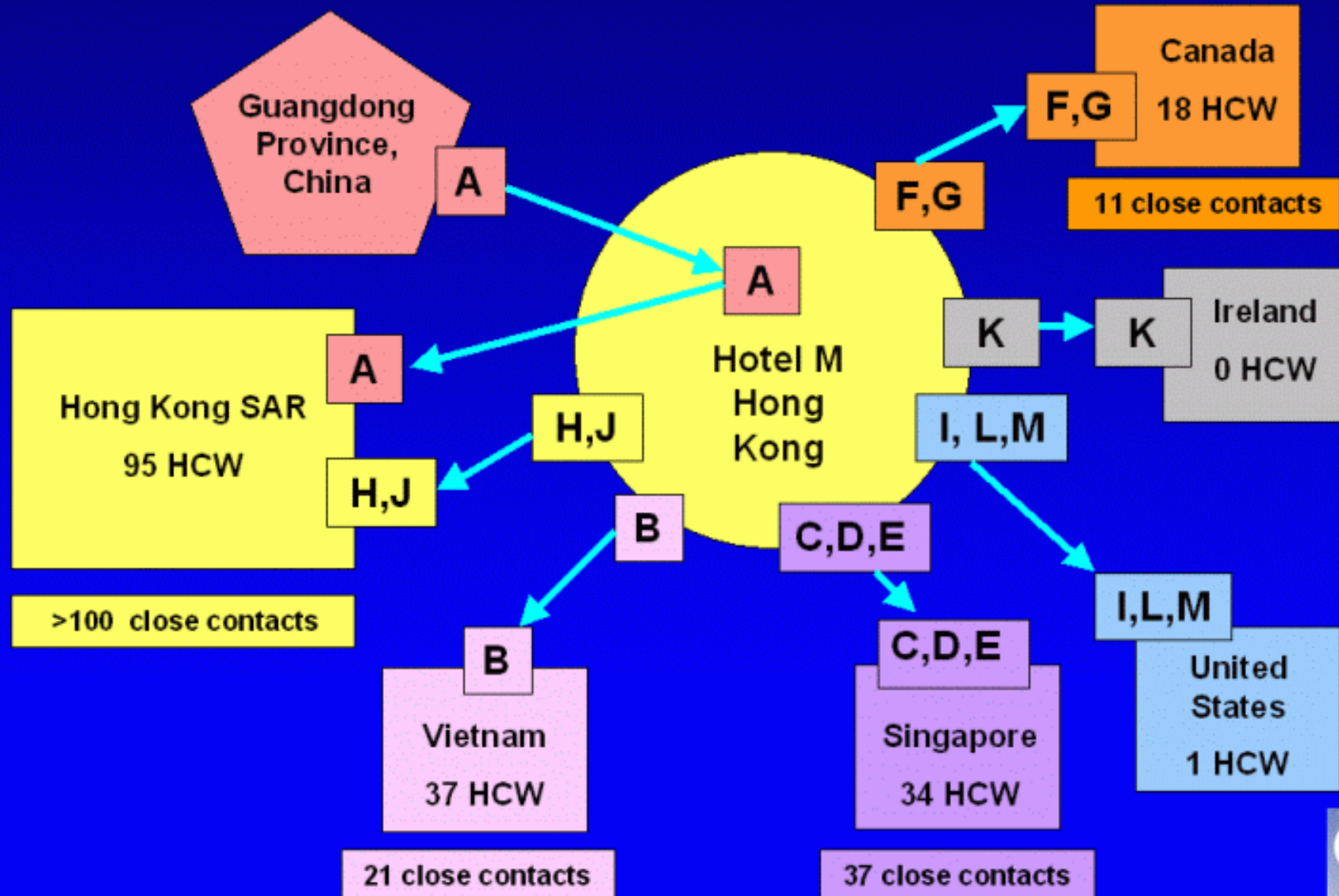
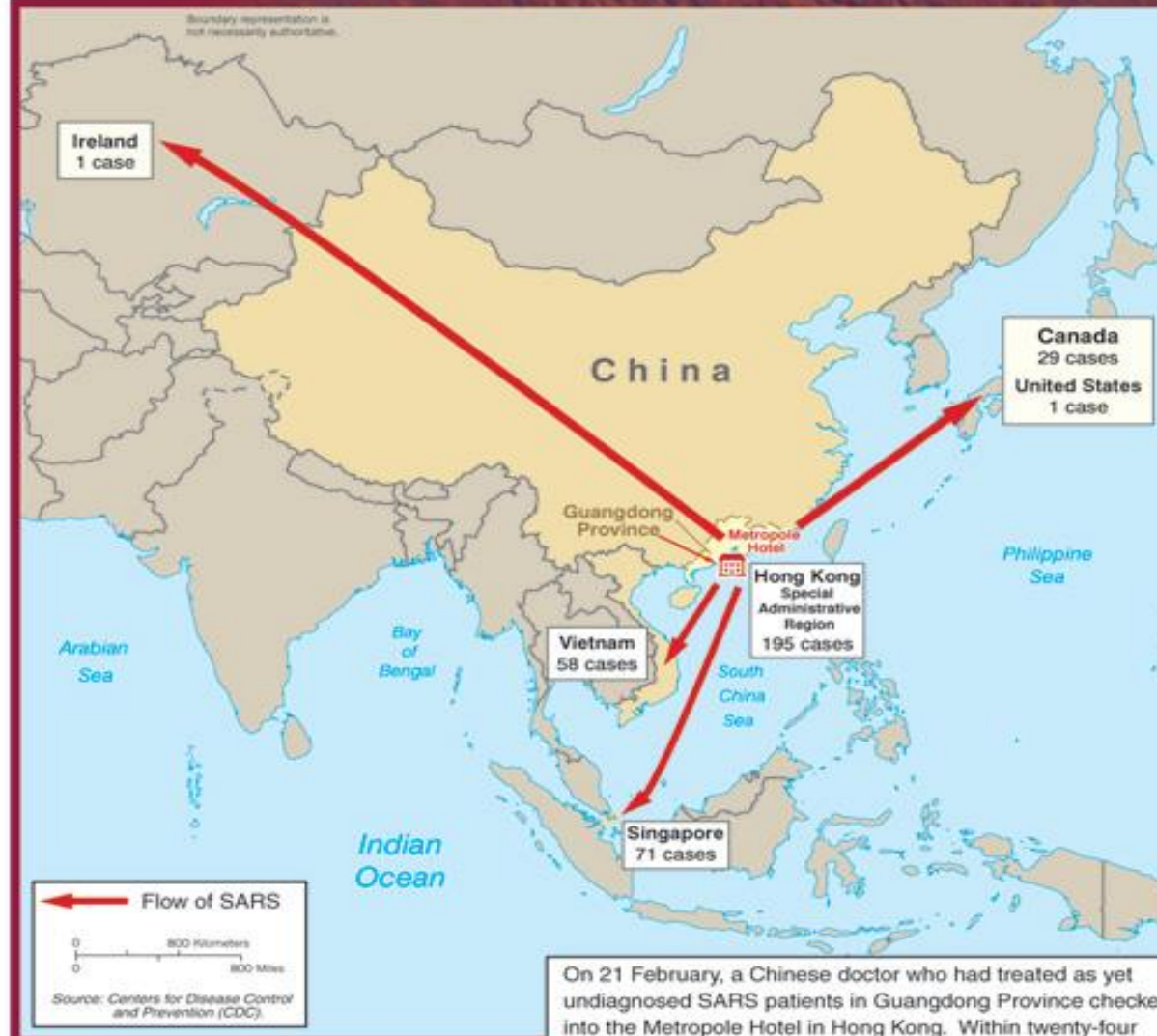




Figure 2
Portrait of a Superspreader: Spread of SARS From
the Metropole Hotel in Hong Kong as of 28 March 2003



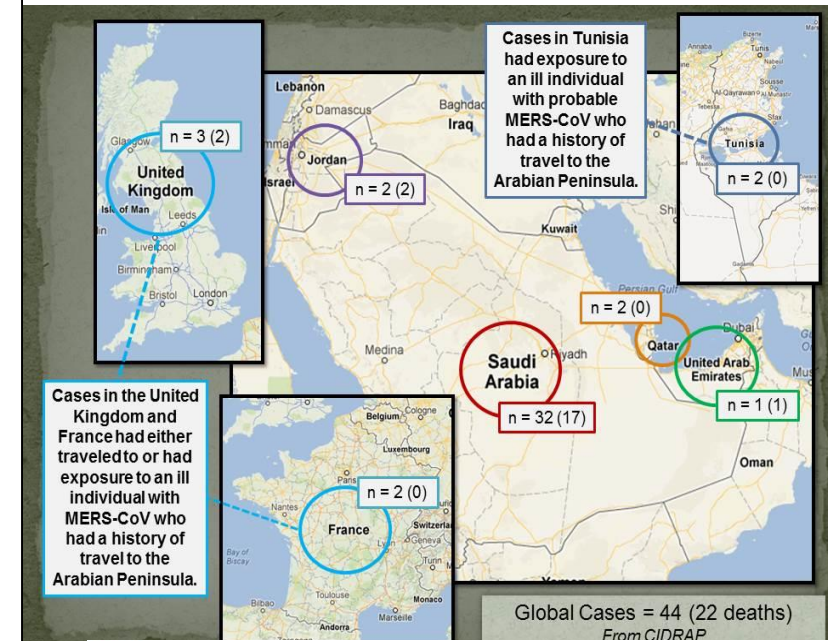
On 21 February, a Chinese doctor who had treated as yet undiagnosed SARS patients in Guangdong Province checked into the Metropole Hotel in Hong Kong. Within twenty-four hours, 12 people who stayed in the same hotel became infected with SARS and took the disease with them to Singapore, Hong Kong, Vietnam, Ireland, Canada, and the United States, infecting directly or indirectly more than 350 people. Eventually, the World Health Organization estimated that from the 1,469

SARS coronavirus (SARS CoV)

- New member of coronavirus family
- Found in wild animals
- Droplet spread
- Less infectious than influenza
- No vaccine/antivirals available

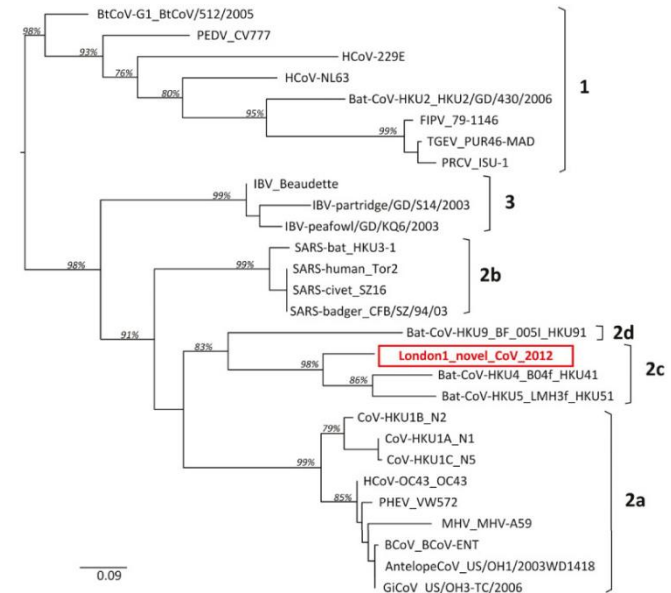
Another Novel Corona Virus

- Discovered in Qatar and Saudi Arabia September 2012
- Distinct from SARS and from the common-cold coronavirus
- Identified as Middle East Respiratory Syndrome Coronavirus (MERS CoV)



FIGURE

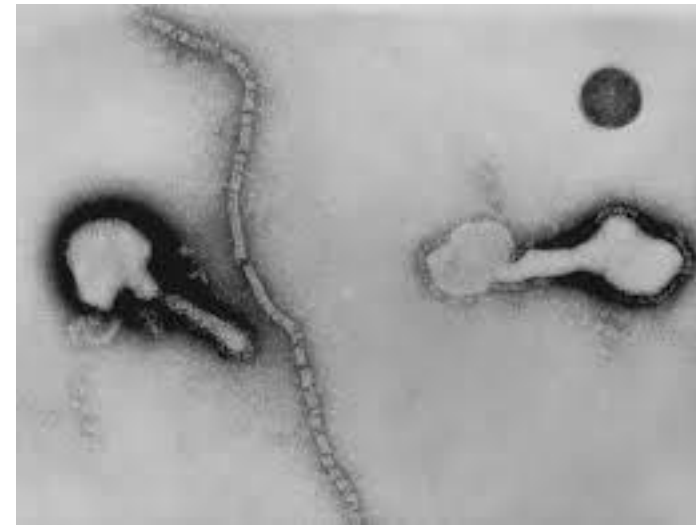
Phylogenetic relationships of partial sequences from the polymerase gene (nsp12) of the coronavirus sequence obtained at the Health Protection Agency, together with representative coronaviruses from different groups



The sequence obtained at the Health Protection Agency has been tentatively named as London1_novel CoV 2012. The phylogenetic tree was

Parainfluenza Virus

- ssRNA virus
- Enveloped
- Pleomorphic morphology
- 5 serotypes: 1, 2, 3, 4a and 4b
- Related to Mumps virus



Laboratory Diagnosis

- Detection of Antigen
- Virus Isolation
- Serology
- Molecular

Management

- No specific antiviral
- No vaccine is available

Respiratory Syncytial Virus (RSV)

- **ssRNA enveloped virus.**
- **Pneumovirus of the Paramyxovirus**
- **Considerable strain variation (subgroups A and B)**
- **Both subgroups circulate in the community at any one time**
- **Causes epidemic**

Infants at Risk of Severe Infection

- 1. Infants with congenital heart disease**
- 2. Infants with underlying pulmonary disease**
- 3. Immunocompromized infants**

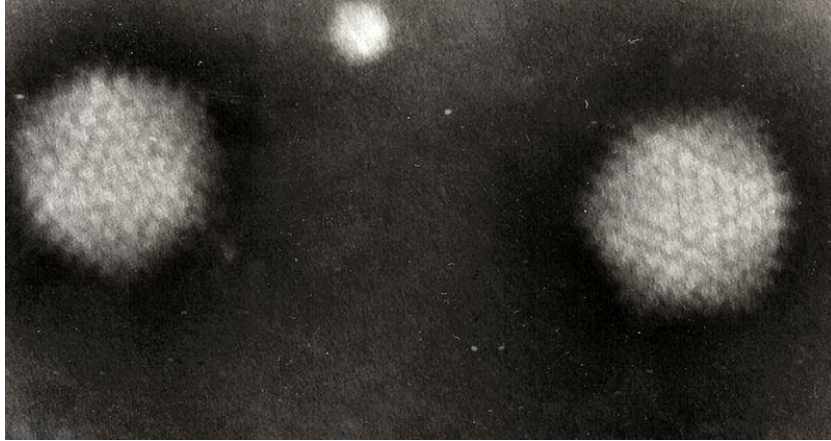
Laboratory Diagnosis

- **Detection of Antigen**
- **Virus Isolation**
- **Serology**
- **Molecular**

Treatment and Prevention

- **Aerosolised ribavirin**
- **No vaccine available**

Adenovirus

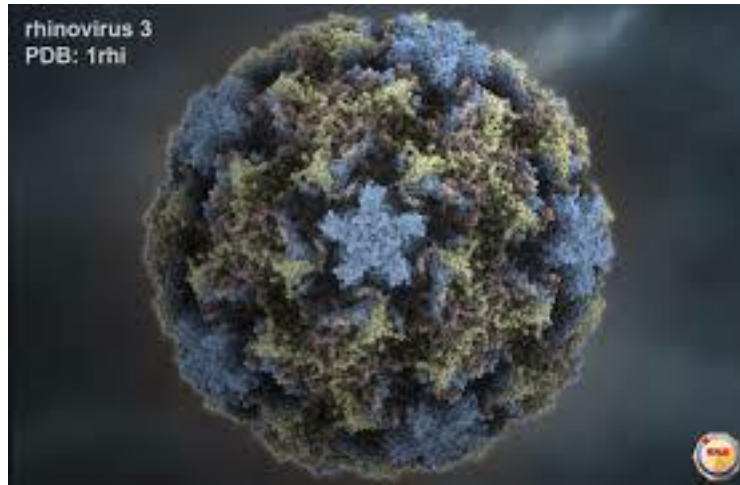


- **ds DNA virus**
- **non-enveloped**
- **classified into 6 subgenera: A to F**
- **57 distinct adenoviral serotypes**
- **Cause a wide range of illnesses**

Clinical Syndromes

- 1. Pharyngitis 1, 2, 3, 5, 7**
- 2. Pharyngoconjunctival fever 3, 7**
- 3. Acute respiratory disease of recruits 4, 7, 14, 21**
- 4. Pneumonia 1, 2, 3, 7**
- 5. Follicular conjunctivitis 3, 4, 11**
- 6. Epidemic keratoconjunctivitis 8, 19, 37**
- 7. Pertussis-like syndrome 5**
- 8. Acute haemorrhagic cystitis 11, 21**
- 9. Acute infantile gastroenteritis 40, 41**
- 10. Intussusception 1, 2, 5**
- 11. Meningitis 3, 7**

Rhinovirus



- **ssRNA virus**
- **picornavirus family**
- **ssRNA virus**
- **More than 100 serotypes are known**