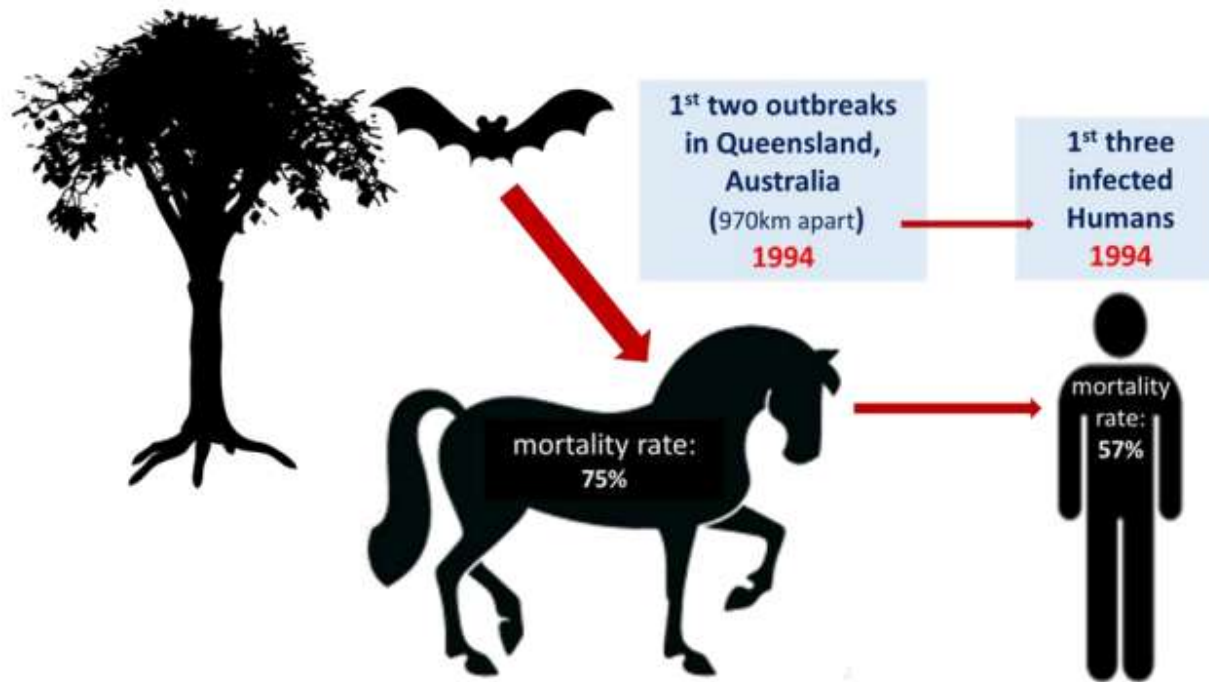


# Emerging Viruses: Hendra & Nipah

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Ph.D. of Virology

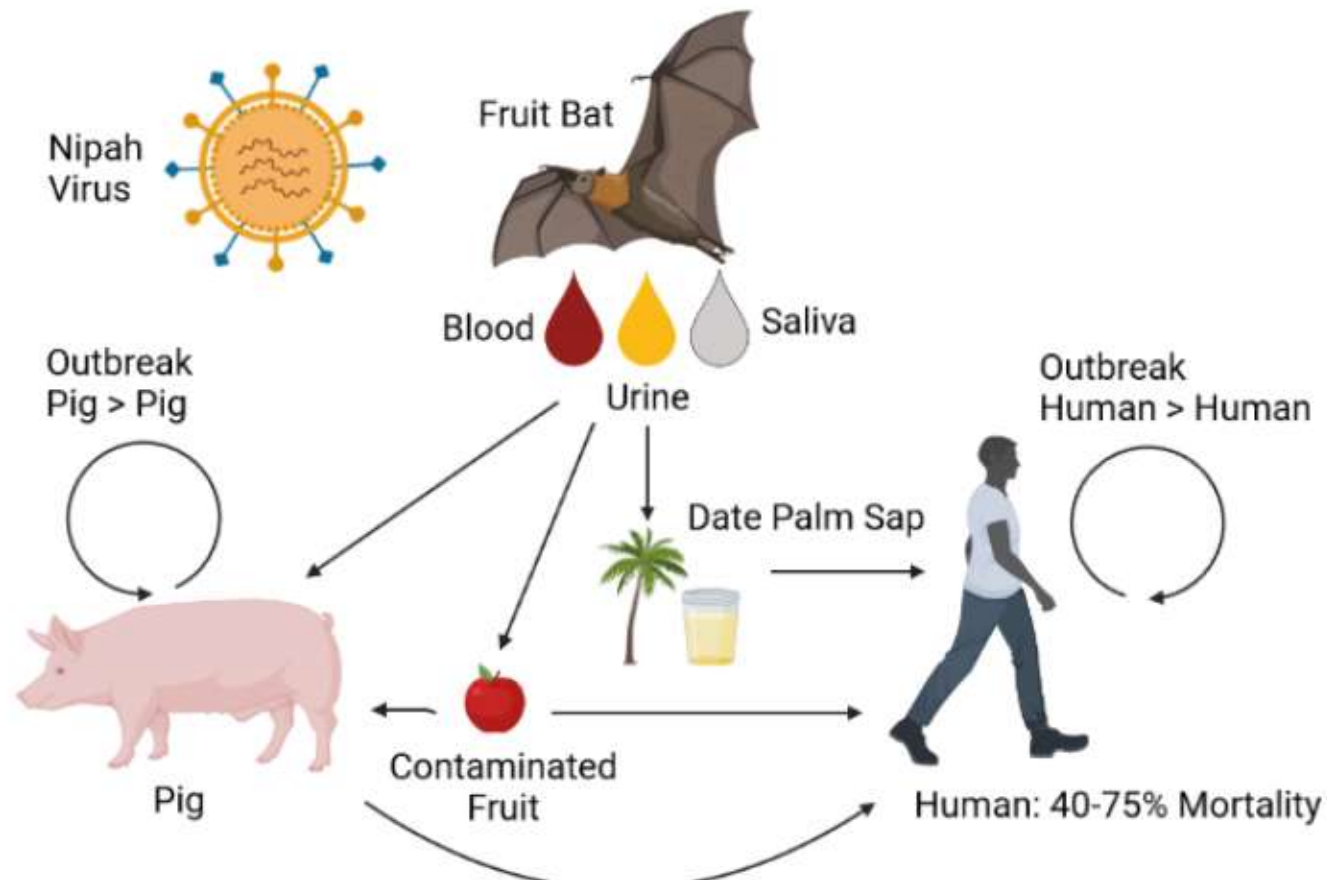
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Hamadan University of Medical Sciences (UMSHA)



**Figure 1.3 – Summary of early Hendra virus epidemiology.**<sup>169</sup>

Diana Helen Mendez: thesis 2005: identification and understanding the factors affecting infection ...

## Nipah Virus Transmission and Mortality



dogs and cats,  
are susceptible  
to Nipah virus

# Introduction

- **spillover:** used to describe when a virus has overcome the many naturally occurring barriers necessary to “spill over” **from one species to another.**
- **Reservoir.** The virus replicates inside a primary host species, such as bats, without compromising the viability of the species, turning the species into a reservoir for the virus.
- **Breakthrough.** The virus overcomes natural barriers such as species incompatibility and immune response in the new host.
- HeV and NiV are not the only paramyxoviruses likely to have a bat origin.

## Microbats



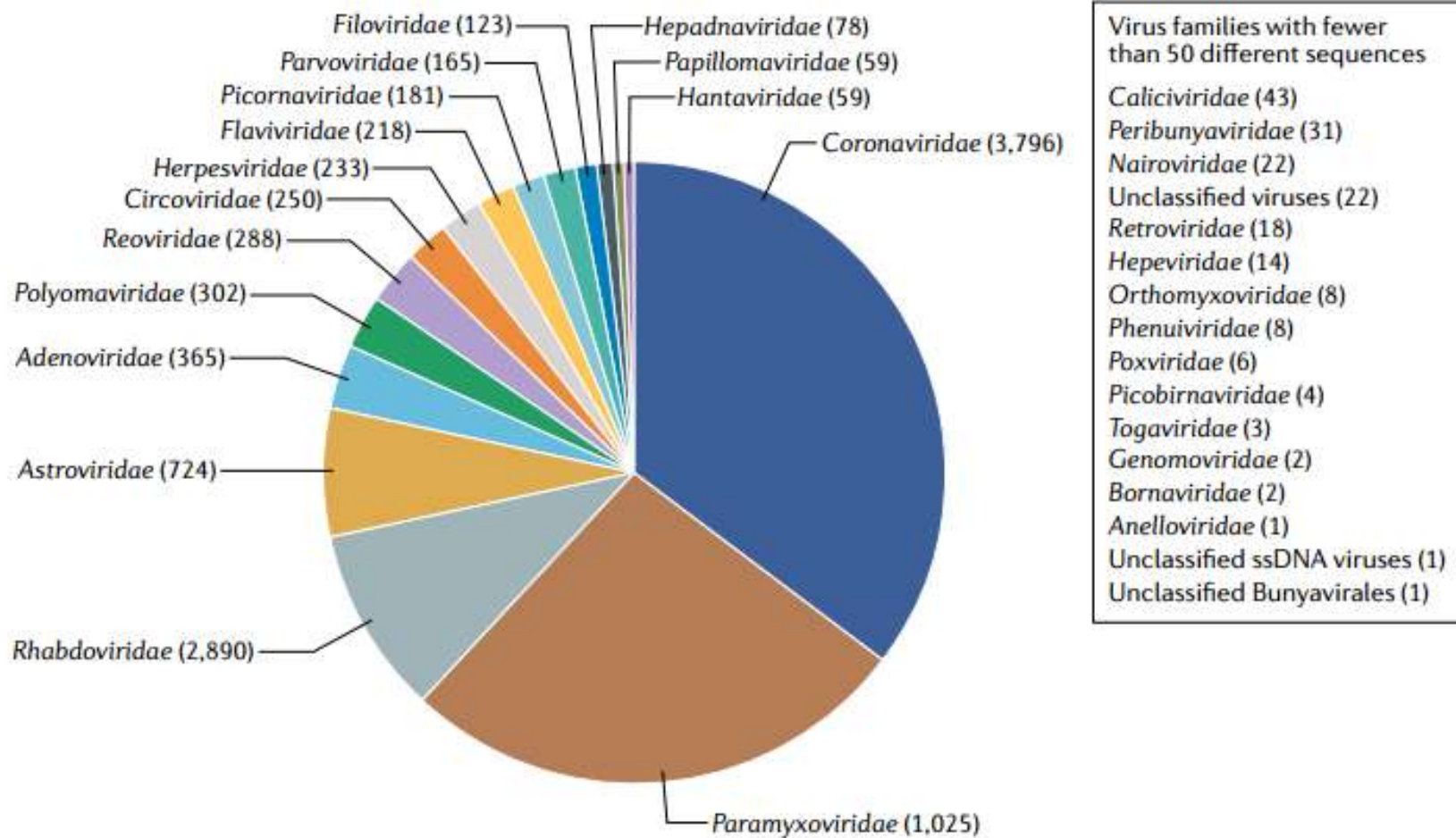
## Megabats (Fruit Bats)

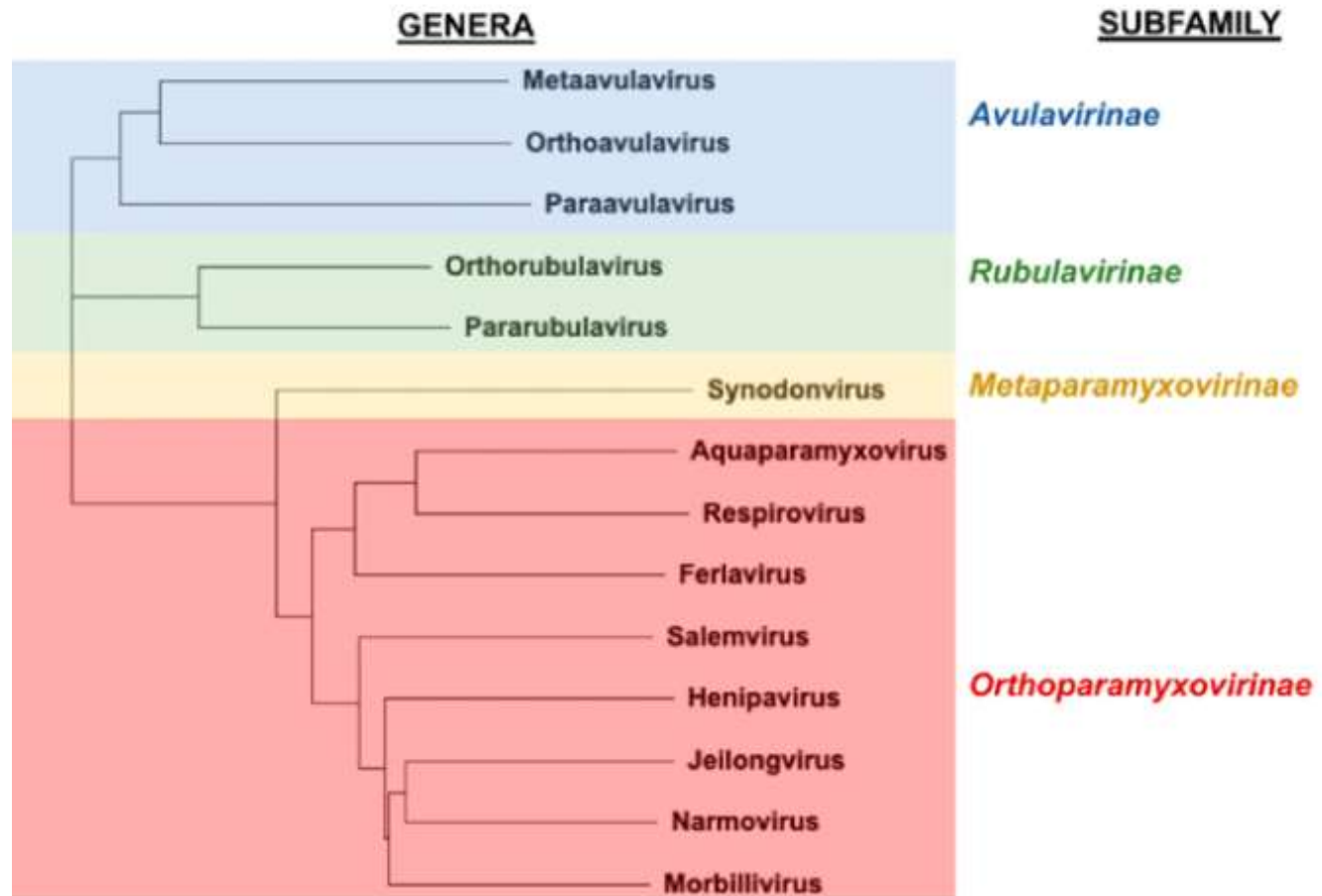


<https://www.animalspot.net/bat>



Types of Bats

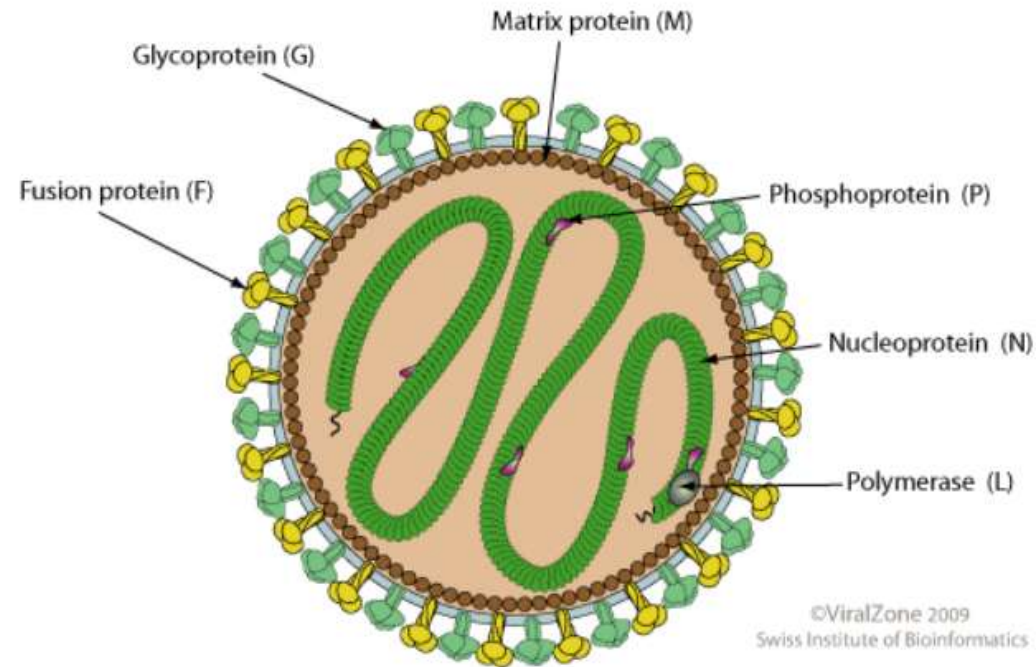




Hendra virus (HeV) and Nipah virus (NiV): The genus **Henipavirus**  
**paramyxovirus**

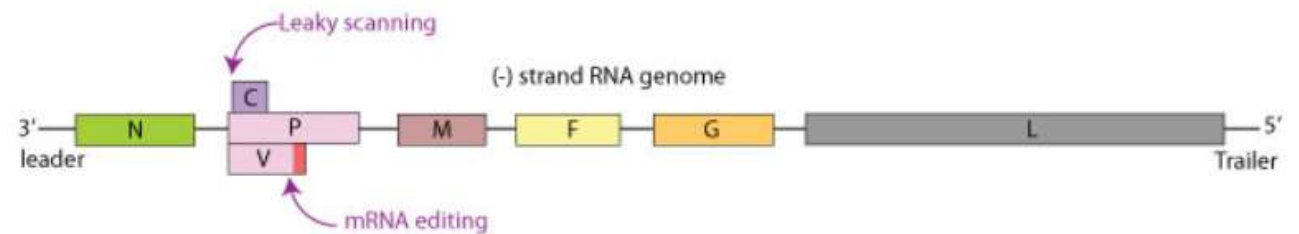


## VIRION



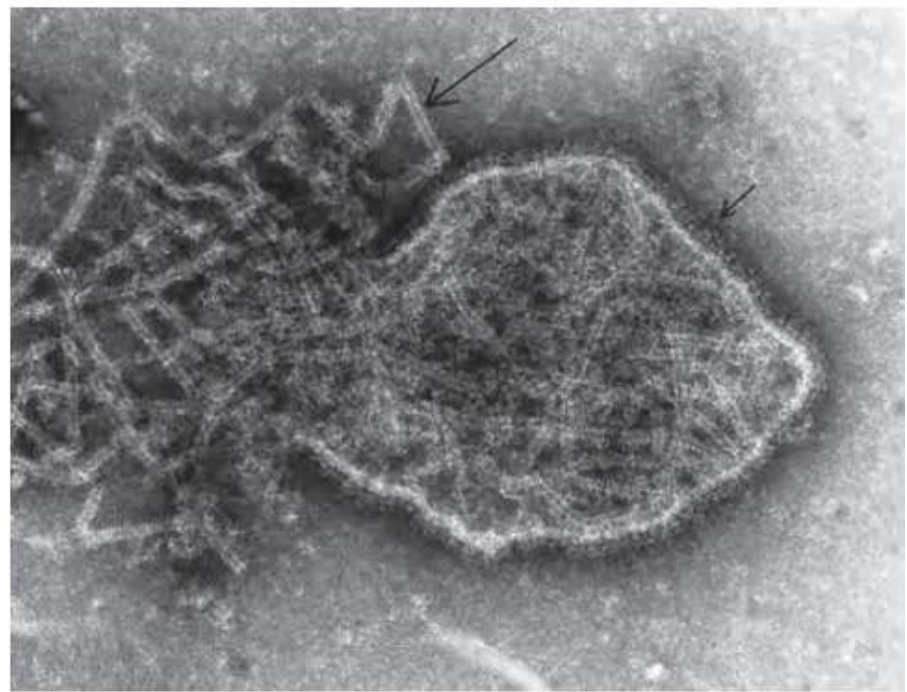
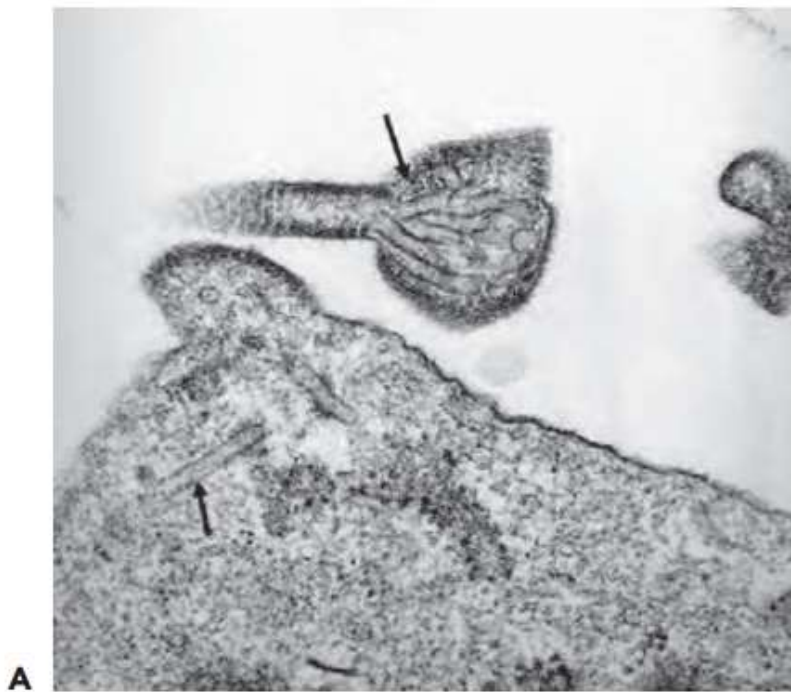
Enveloped, spherical. Diameter from about 150nm.

## GENOME

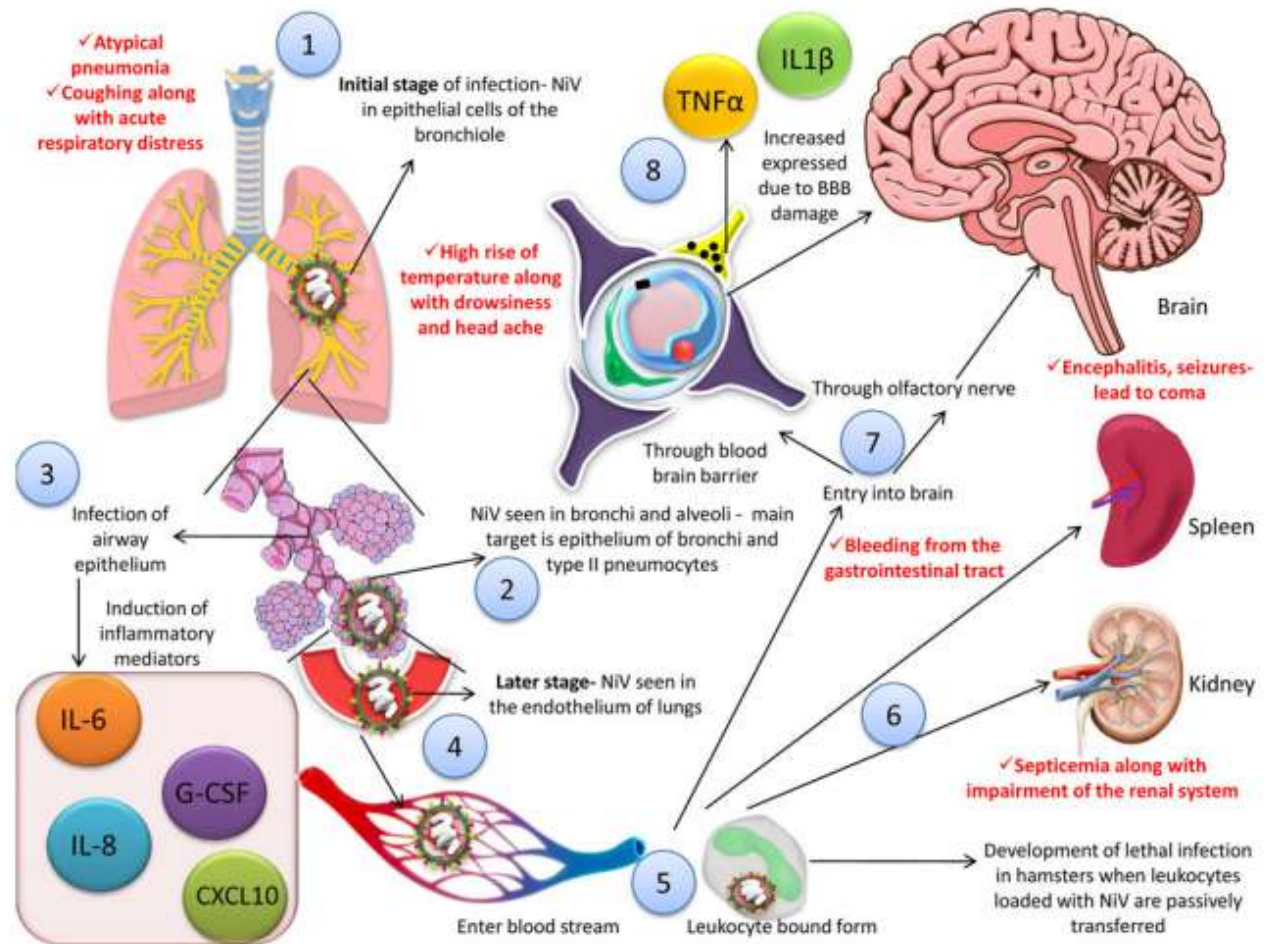




Electron micrograph of Nipah virus (NiV)-infected Vero cells showing tubule-like structures,



# Henipavirus infections



# Henipavirus infections

- Both HeV and NiV display a predominantly respiratory or **neurological tropism**, depending on the host.
- Infections can be associated with high morbidity and case-fatality rates, such as in HeV infection of **horses** and NiV and HeV infections of people, or lower morbidity and mortality rates, best represented by NiV infection of pigs.

# Hendra virus infections

- A total of **seven** humans have contracted **Hendra virus** from infected horses,
- Cases have an acute **influenza-like illness** that may progress to pneumonia or encephalitis and meningitis.
- Autopsy has confirmed both **lung and brain involvement**.
- Pneumonitis was present, characterized by the presence of **syncytia, giant cell formation, and inclusion bodies**.
- **Necrotizing alveolitis** with extensive cellular infiltration was evident.

# Nipah virus infections

- This outbreak resulted in nearly 300 human **cases** and more than 100 deaths
- In humans, symptomatic NiV infection has mainly taken the form of **severe acute encephalitis**.
- Many NiV infected patients have **reduced levels of consciousness** at presentation and signs consistent with brain-stem involvement.
- However, up to 25% of cases also exhibited **respiratory signs**
- Symptoms from infection vary from **none** to **fever, cough, headache, shortness of breath, and confusion**

# henipavirus infections

- Marked thrombocytopenia is seen in a third of cases, with occasional leukopenia, and the CSF contains lymphocytes, elevated protein levels, and anti-henipavirus antibodies.
- Disseminated vasculitis with endothelial syncytia, leading to thrombosis and perivascular hemorrhage, is a hallmark of the pathological changes with both Hendra and Nipah viruses.

# Outcome of Infection

- Most patients who survived acute NiV encephalitis made a full recovery
  1. approximately **20% had** residual neurologic deficits
  2. cognitive difficulties,
  3. tetraparesis
  4. cerebellar signs, (Ataxia, Nystagmus )
  5. Clinical depression



# Outcome of Infection

- brain lesions revealed by MRI disappeared or became smaller over a period of 12 to 18 months, although some remained unchanged during this period.

# Henipavirus Detection

- ELISA: During acute and convalescent stages of the disease,
- RNA can be detected using reverse transcriptase RT-PCR from throat swabs, cerebrospinal fluid, urine and blood analysis.

# Host range

- Unlike other members of the *Paramyxoviridae*, which have a limited host range
- **Henipaviruses** naturally infect flying foxes, horses, pigs, cats, dogs and humans
- Experimental investigations have extended this host range to include guinea pigs and hamsters.

# Genetic Diversity

- Partial genome sequencing revealed that HeV isolated from equine and human sources during the outbreak in Brisbane appears identical and differs little from HeV isolated from flying foxes 2 years later.
- Sequencing of five additional horse isolates from five different locations from the 2006 to 2008 HeV occurrences has demonstrated a very high genetic similarity.

# Genetic Diversity

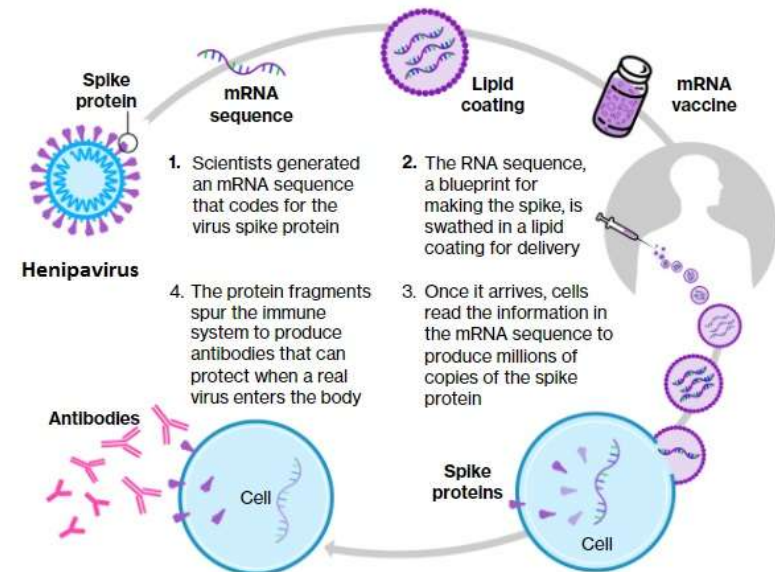
- Similar observations were made in Malaysia, where it was demonstrated that NiV isolated from pigs at the height of the outbreak and at its geographic focus were essentially identical to human isolates made at that time and isolates obtained from lying foxes several years later.
- In Bangladesh, four human isolates obtained in 2004 demonstrate significant genetic heterogeneity and suggest multiple spillovers of NiV from lying foxes into the human population.

# Genetic Diversity

- The presence of henipavirus-reactive (**but not neutralizing**) antibodies in bats from other regions of the world predicts that a much greater genetic diversity of henipaviruses exists in different bat populations.

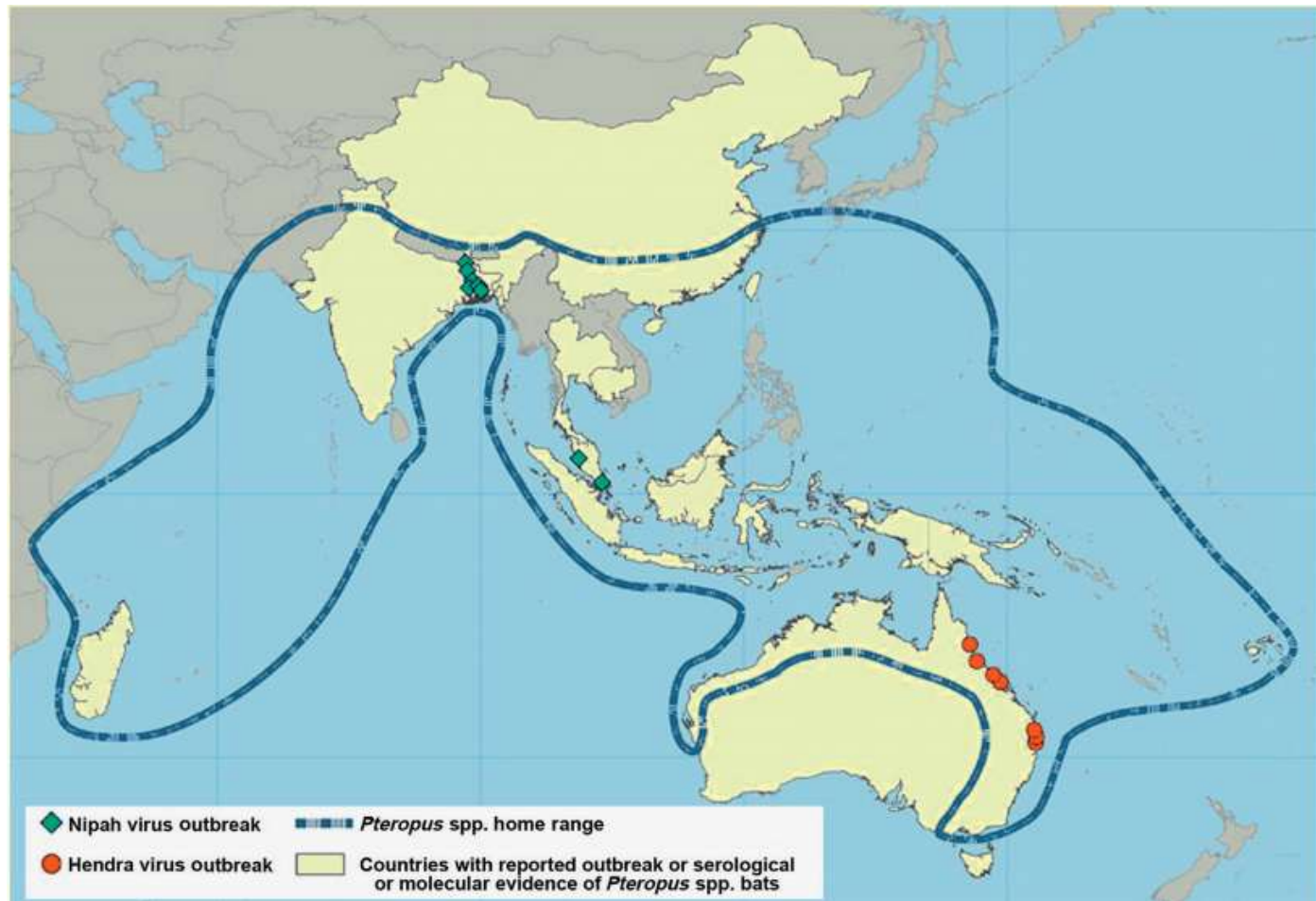
# Vaccines

- Protein based vaccine
- **mRNA vaccines**



Sources: Pfizer, Bloomberg research





From CDC, 2014.

# suggestions

- **Imported animals** from suspected countries must be considered.
- Screening of suspected animal with Hendra signs and symptoms
- WHO collaboration

- **The susceptibility of humans, the high virulence of the viruses and the absence of therapeutic modalities and vaccines have led to the classification of HeV and NiV as Biosafety Level 4 (BSL4) pathogens.**