

ECOHEALTH AND THE IDENTIFICATION OF NEW VIRUSES

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During the past decade many new diseases have emerged from the environment and into society where there have been impacts on human and/or veterinary health, trade and the 'health' of the environment. In nearly all cases the emergence can be attributed to environmental perturbations via some aspect of human behaviour. Examples of such environmental perturbations can include altered habitat (changes in the number of vector breeding sites and/or host reservoirs), niche invasions (interspecies host-transfers), changes in biodiversity, human-induced genetic changes of disease vectors or pathogens (e.g. mosquito resistance, emergence of disease resistant strains of microbes) and environmental contamination of infectious agents (e.g. dissemination of microbes into water bodies). Whilst the significance of this area of 'health' is emerging in terms of politics, general health and trade there is a requirement to provide an infrastructure for the rapid and accurate identification of infectious agents that can be redistributed to new hosts and give rise to new diseases; these diseases are often referred to as emerging diseases.

In virology, the recognised technologies associated with identification and characterisation of infectious agents associated with emerging diseases include classical virology, serology, histopathology, and electron microscopy. Recent advances in molecular biology in areas such as real time PCR, genomic subtraction, microchip arrays in addition to other multiplex-based assays have caused some people to become confused about the on-going relevance of electron microscopy. For the foreseeable future, electron microscopy will continue to play a vital role in identification of infectious agents associated with major disease incidents that have severe implications on (a) human and veterinary health (e.g. FMD, forms of transmissible spongiform encephalitis and incidences involving encephalitis and respiratory disease – i.e. suspected involvement of henipaviruses) and (b) the health of free-ranging animals (e.g. chytridiomycosis (amphibians), kangaroo blindness (kangaroos) and haematopoietic necrosis (aquatic organisms)). The discipline has always, and continues to be, a multiplexed assay that has the capacity to generate data sets on virus structure, morphogenesis and antigenicity in both cell culture and clinical samples. Collation and interpretation of these data sets in line with established guidelines provides a rapid and reliable process for identification of infectious agents to the level of Order, Family, Sub-Family and even Genus. This capacity is of enormous benefit for the identification of new viruses that will continue to emerge from a once healthy environment.

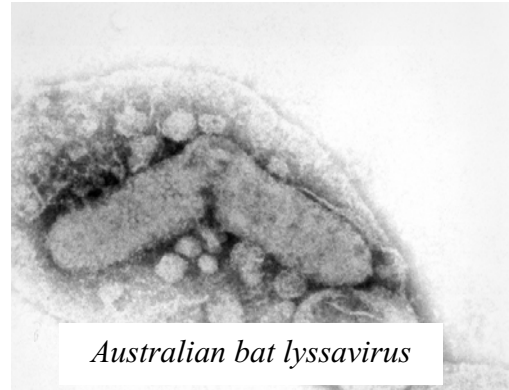
In this presentation a brief history and overview will be given on the relevance of the health of the environment to the continued emergence of pathogens and the role of electron microscopy in their identification. Specifically, different techniques will be discussed in terms of how they contribute to pathogen identification and characterization.

An example of recently identified viruses and the level of classification that can be achieved with classical electron microscopical protocols.

The following bat viruses can be identified and discriminated by different electron microscopical protocols. With the use of negative staining (NCEM), examination of ultra-thin sections (TS) and immuno-electron microscopy (IEM), the following viruses (Hendra virus, Nipah virus, Tioman virus, Menangle virus, Australian bat lyssavirus, Broom virus and Nelson Bay virus) can be quickly classified into their respective 'groups'. Note; Hendra virus (*) can be differentiated from Nipah virus via the examination of TS and NCEM.

Order: *Monegavirales*
Family: *Rhabdoviridae*
Genus: *Lyssavirus*

- *Australian bat lyssavirus*



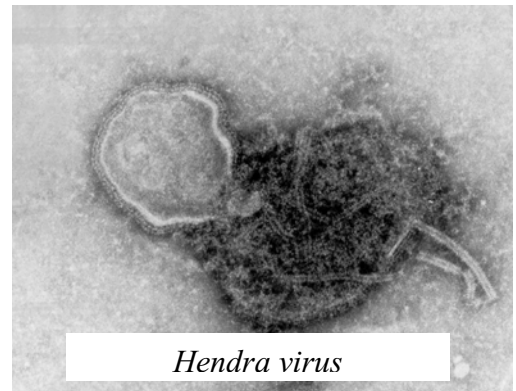
Australian bat lyssavirus

Order: *Monegavirales*
Family: *Paramyxoviridae*
SubFamily: *Paramyxovirinae*
Genus: *Henipavirus*

- *Hendra virus**
- *Nipah virus*

Genus: *Rubulavirus*

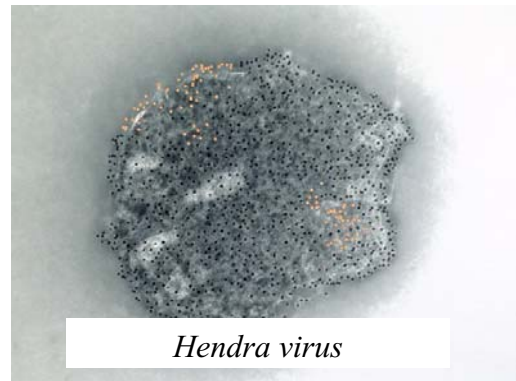
- *Menangle virus*
- *Tioman virus*



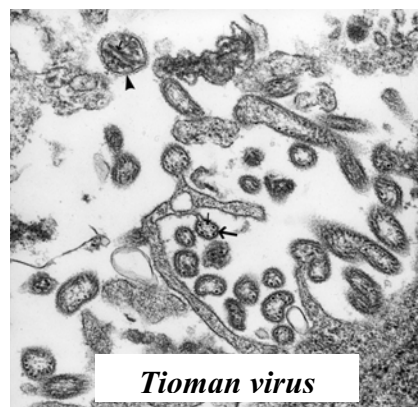
Hendra virus

Family: *Reoviridae*
Genus: *Orthoreovirus*

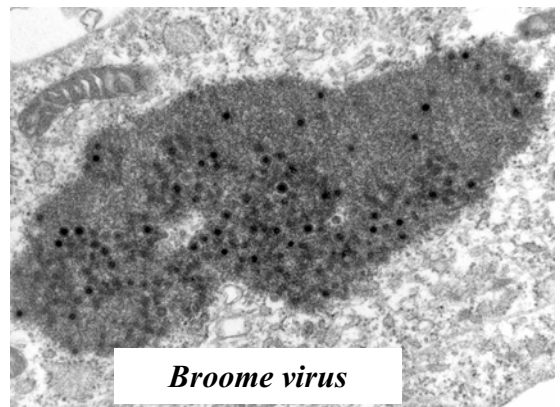
- *Nelson Bay virus*
- *Pulau virus*
- *Broome virus*



Hendra virus



Tioman virus



Broome virus