

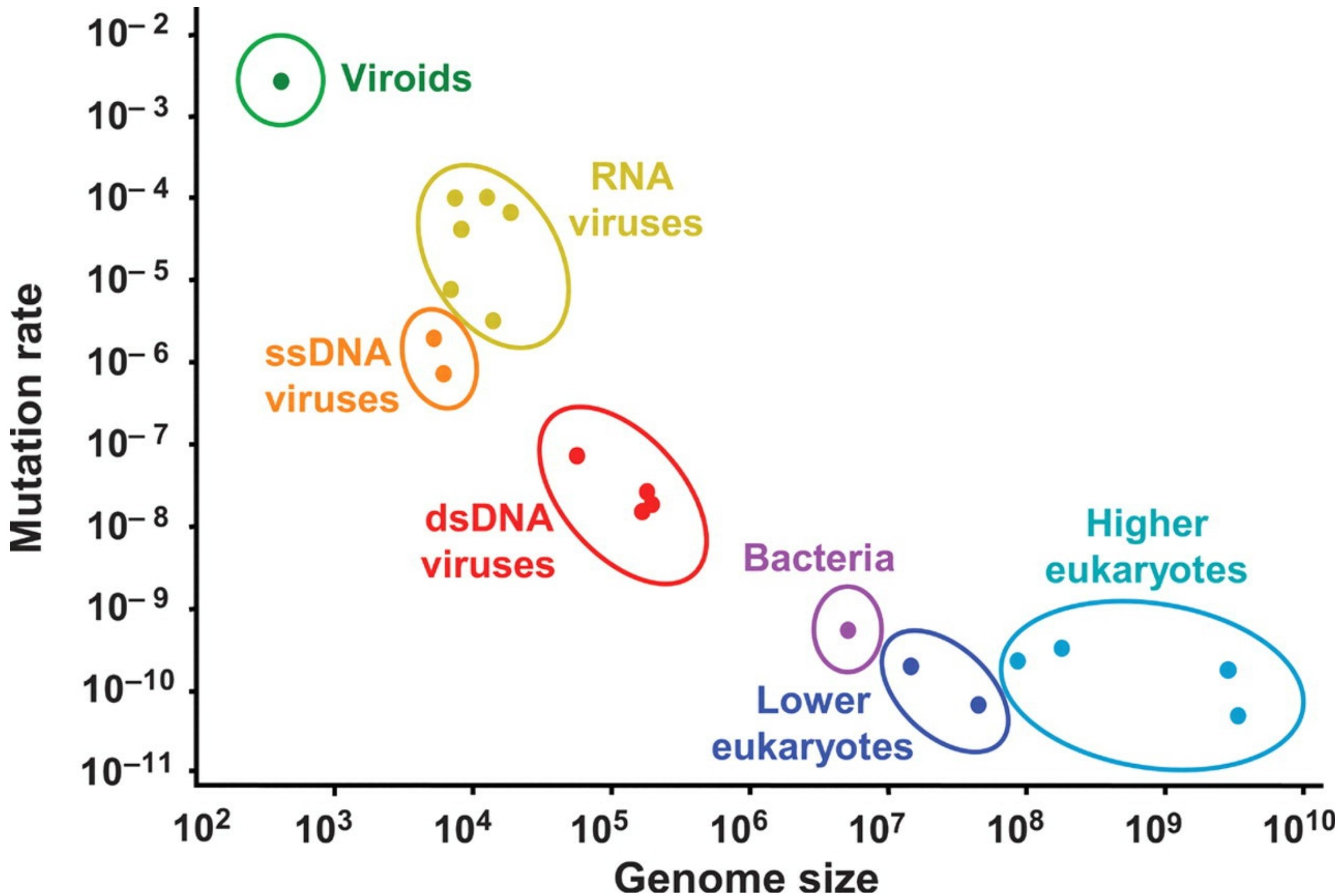
# Pathogen diversity

A pathogen is a disease-causing biological entity capable of replication within a host and transmission between hosts

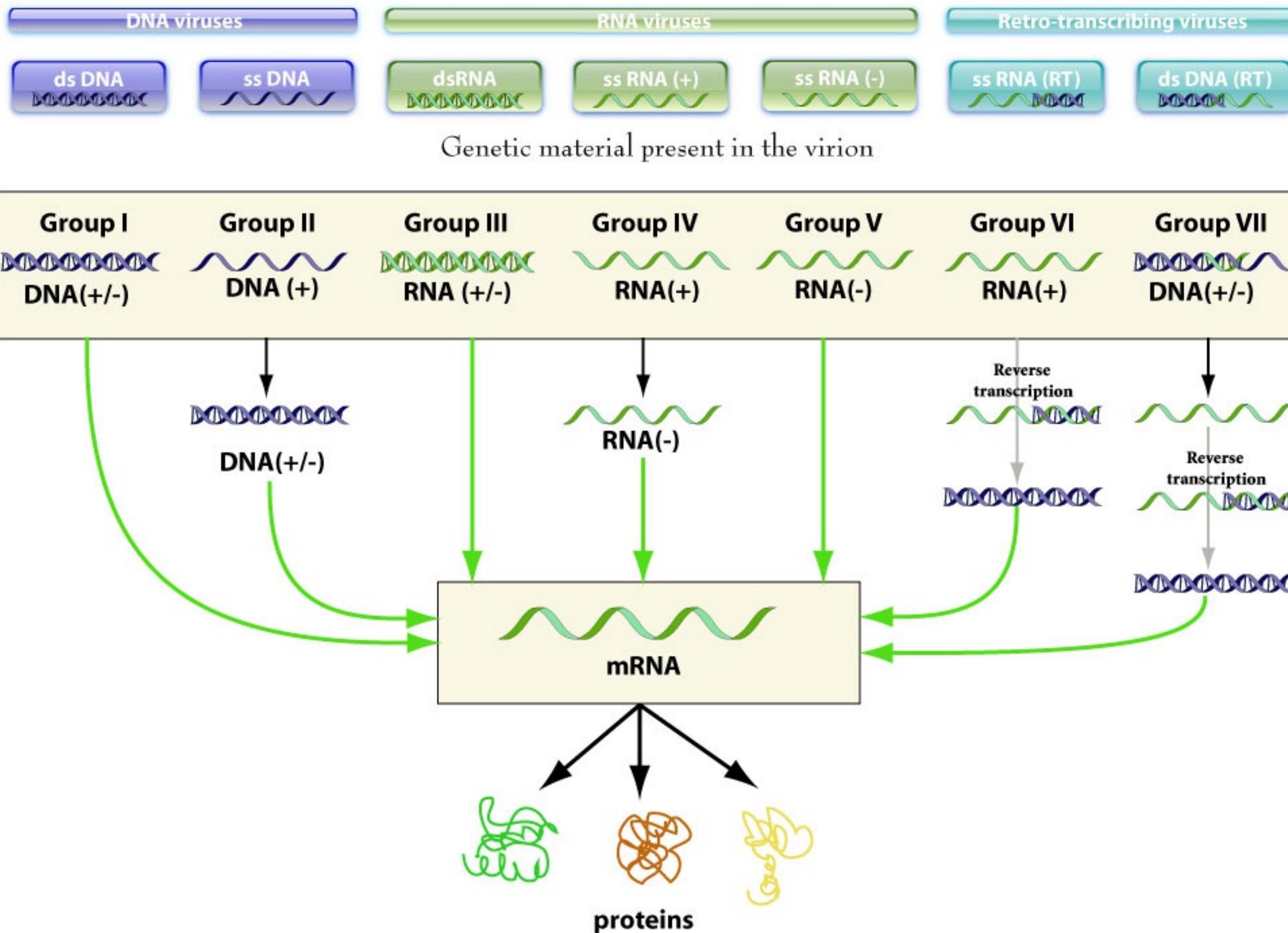
# Broad categories

1. RNA viruses
2. DNA viruses
3. Bacteria
4. Parasites and fungi

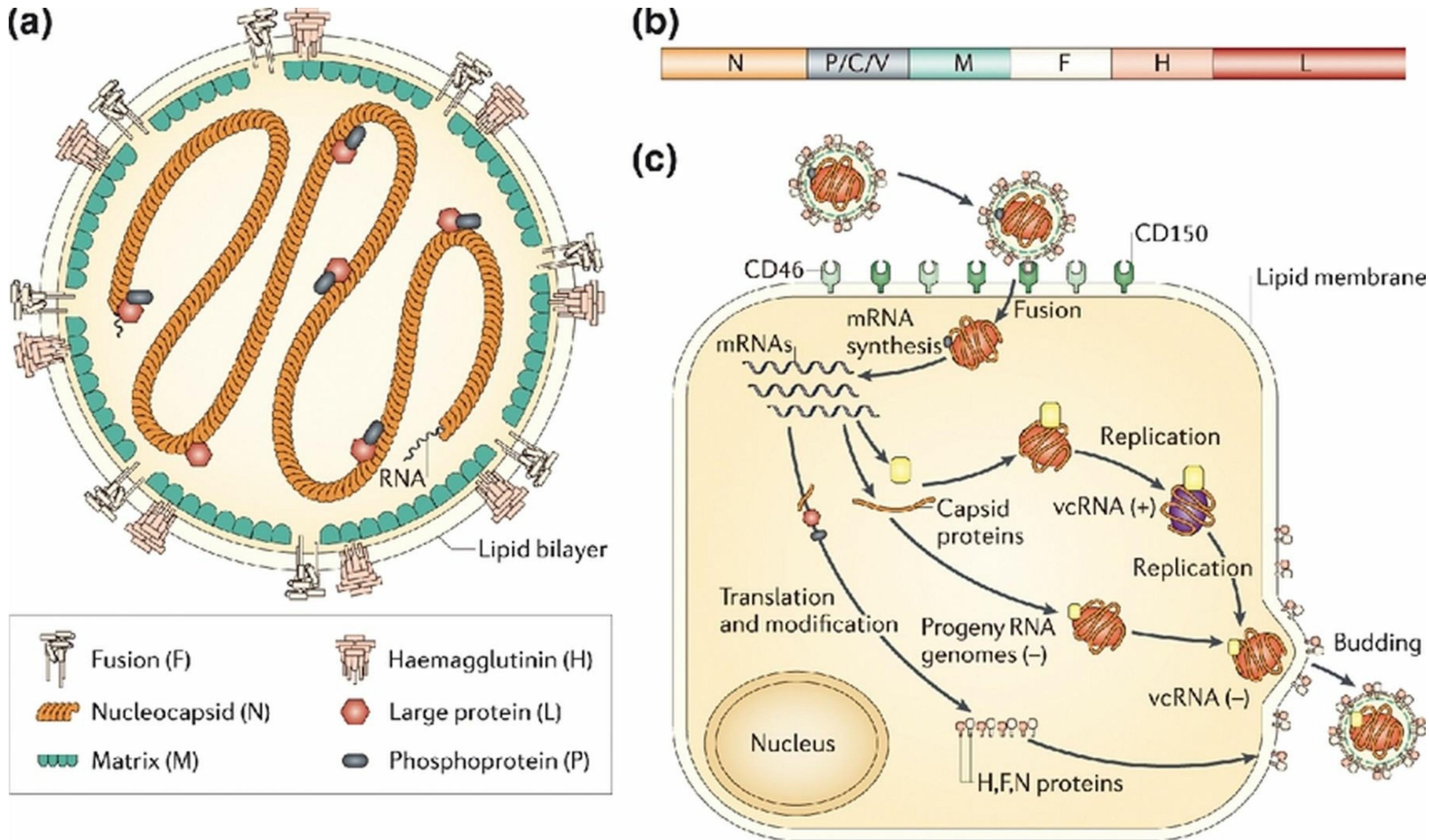
# Mutation rate varies with genome size



# Baltimore classification system

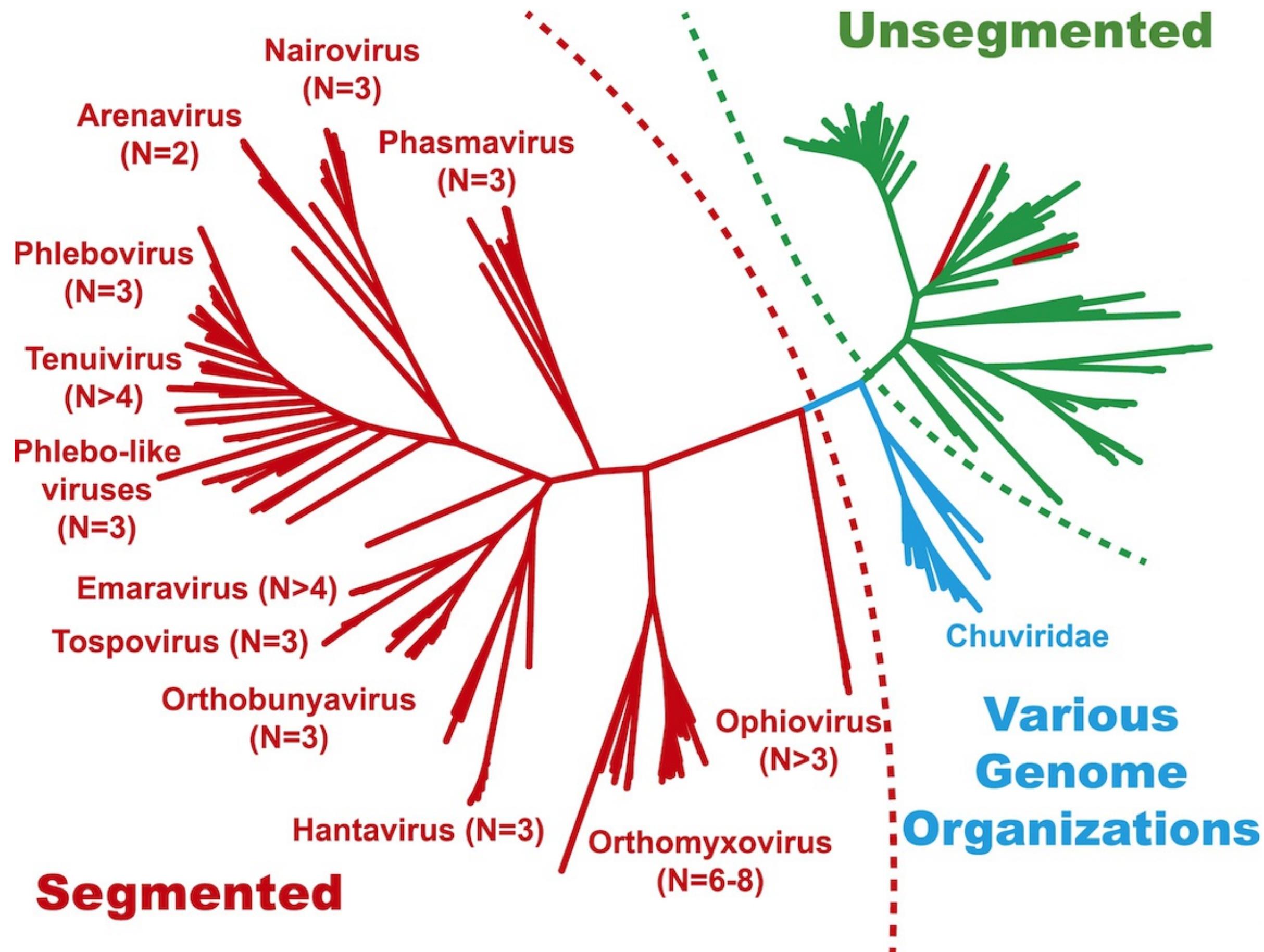


# ssRNA virus lifecycle

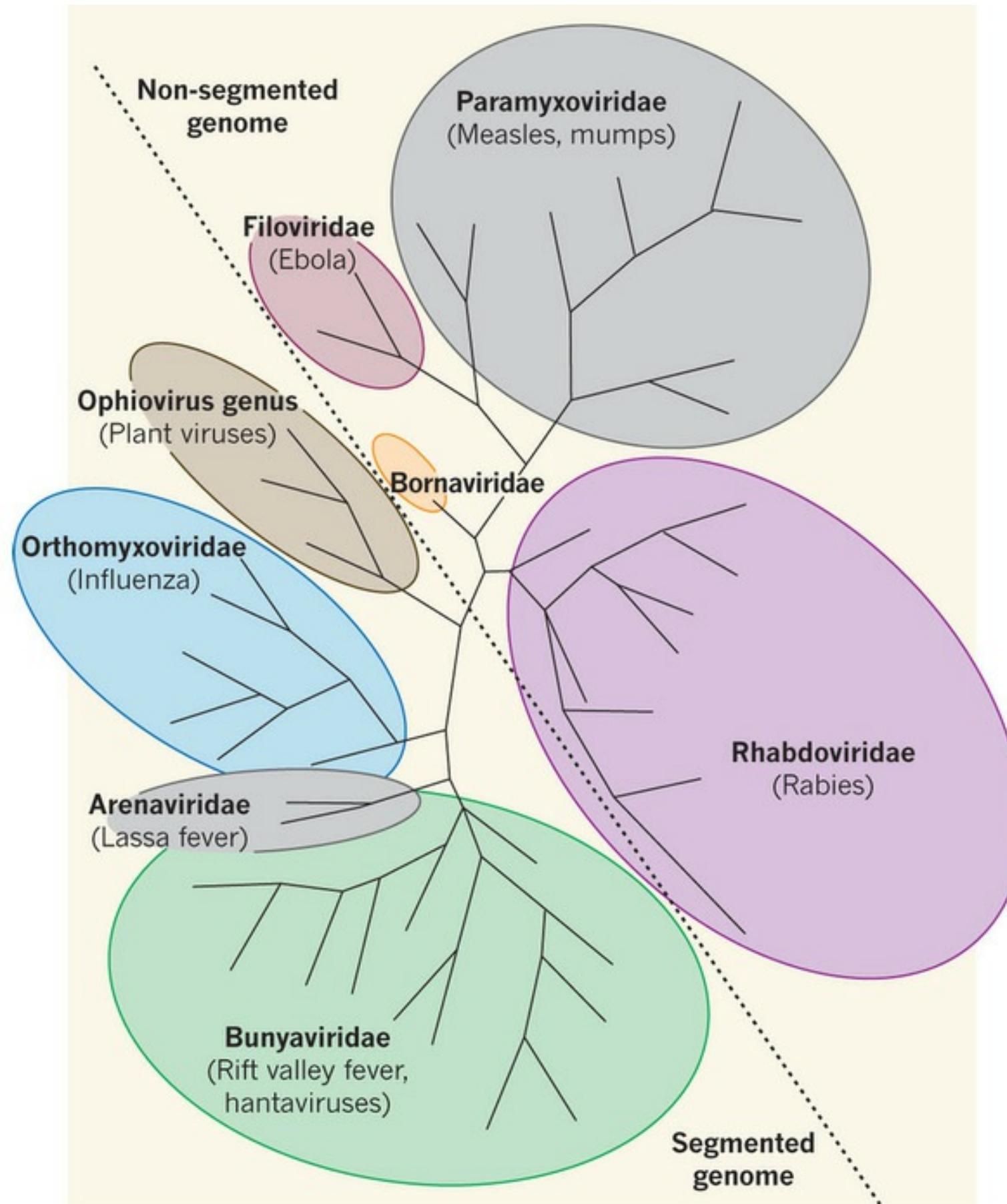


Griffin et al. 2012

# Negative-sense RNA virus phylogeny



# Negative-sense RNA virus phylogeny



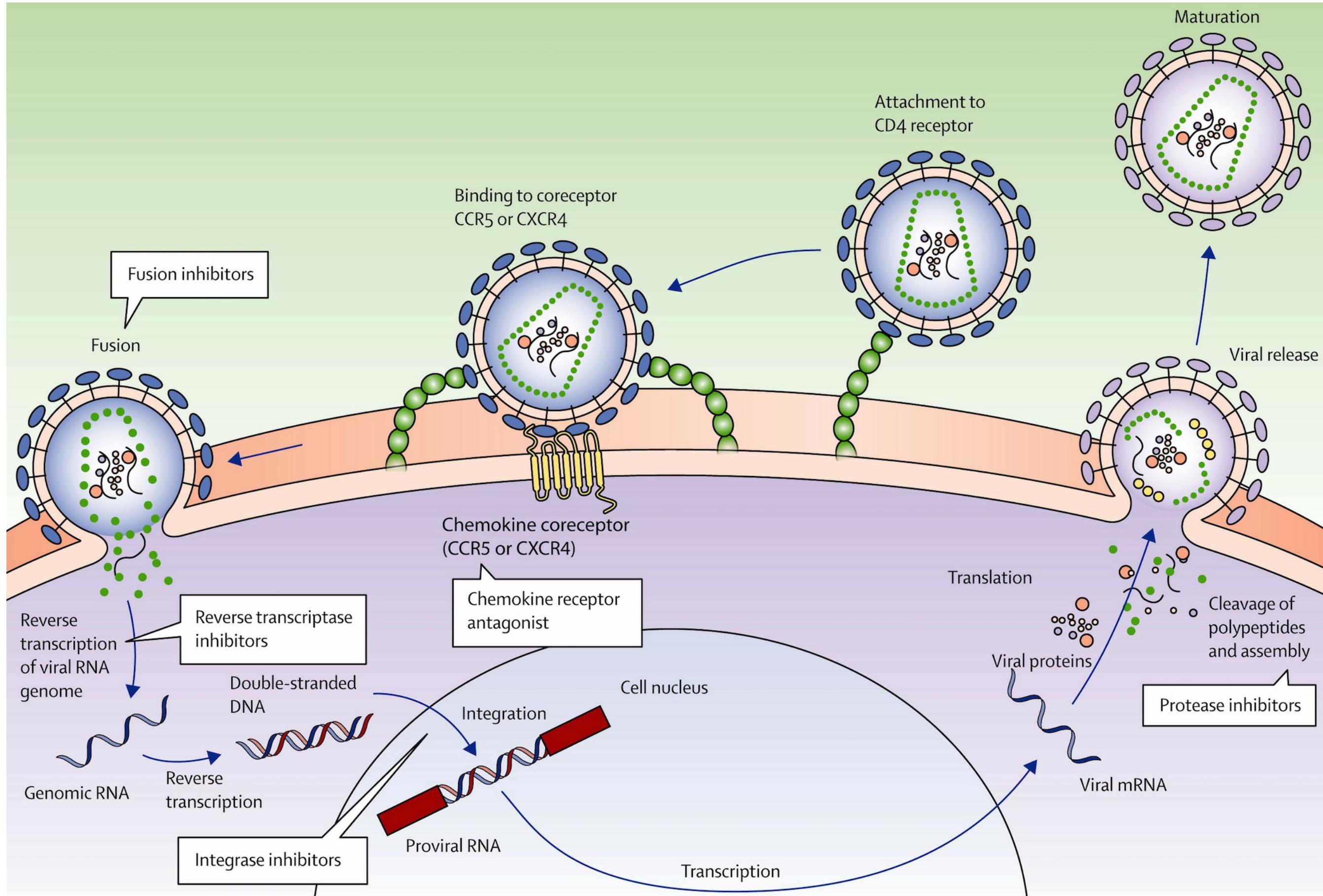
# Negative-sense RNA viruses

- Influenza
- Measles
- Ebola
- Rabies
- Lassa
- Hanta
- Respiratory syncytial virus (RSV)

# Positive-sense RNA viruses

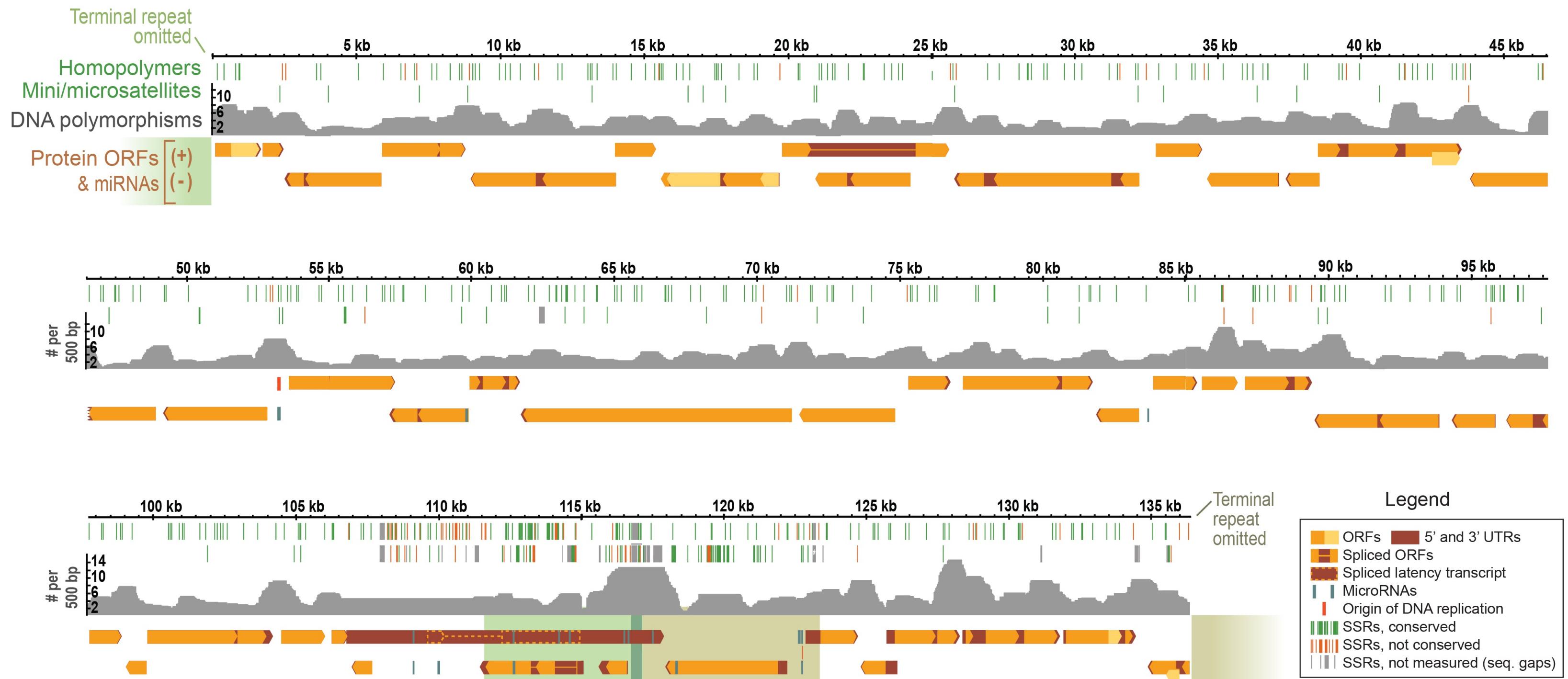
- Flaviviruses: Yellow fever, West Nile, Dengue, Zika, HCV
- Coronavirus
- Rhinovirus
- Polio
- Norovirus
- Chikungunya

# Retrovirus lifecycle



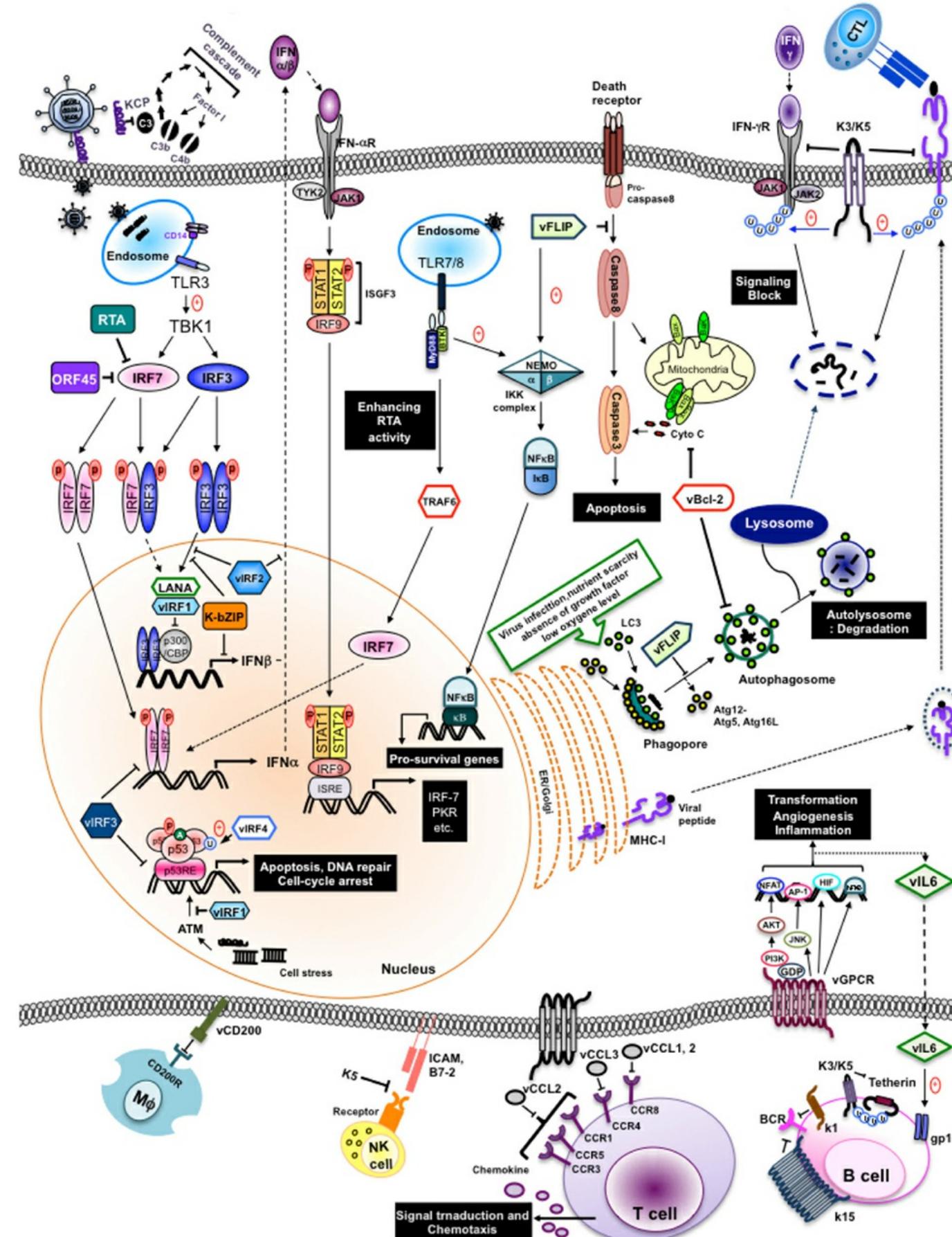
Maartens et al. 2014

# DNA virus genomes



Szpara et al. 2013

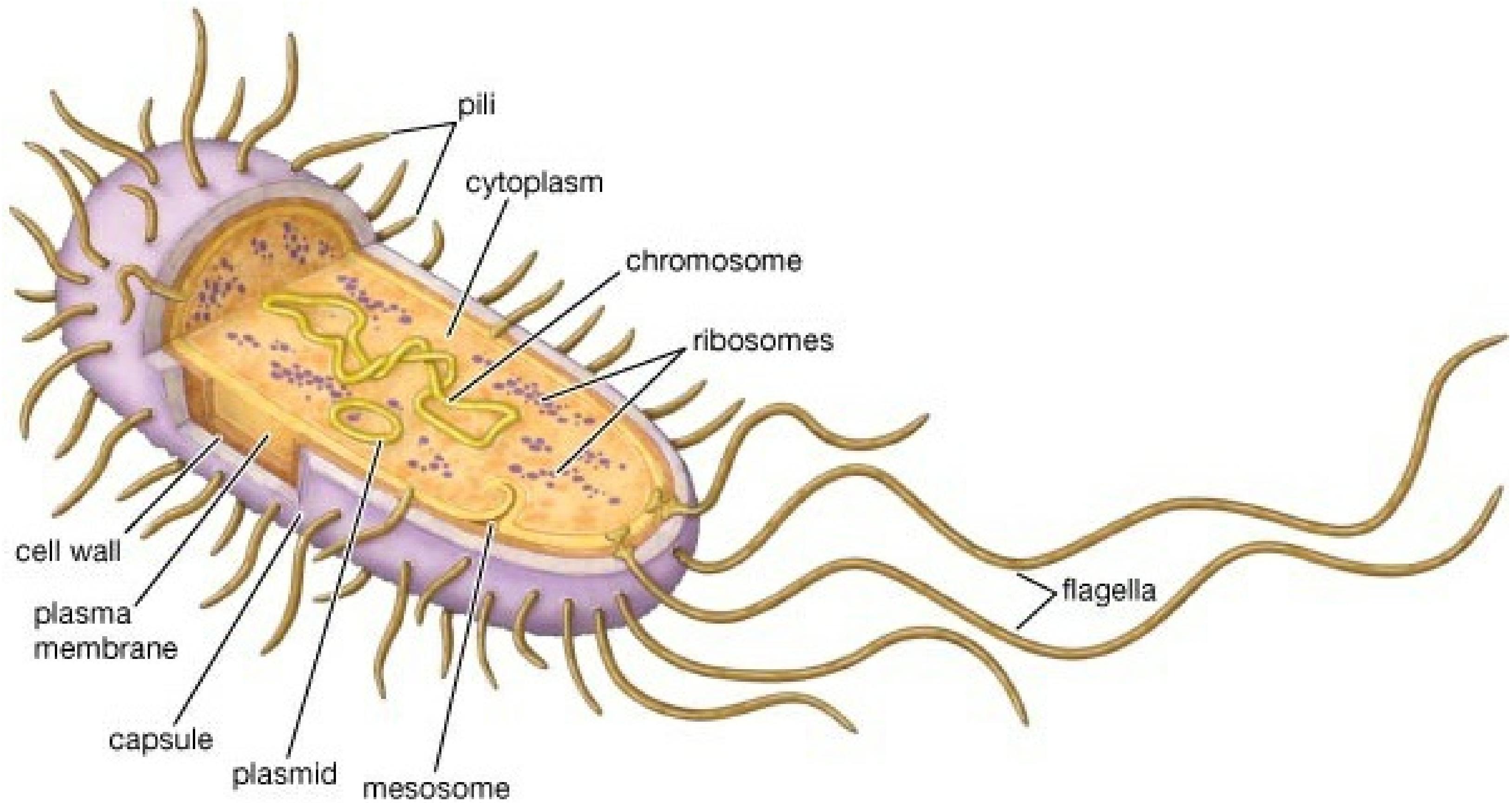
# Bigger genome allows for more functions



# DNA viruses

- Herpesviruses: HSV, Epstein–Barr virus (EBV), Varicella, Cytomegalovirus (CMV), Kaposi's sarcoma-associated herpesvirus (KSHV)
- Papillomavirus (HPV)
- Smallpox

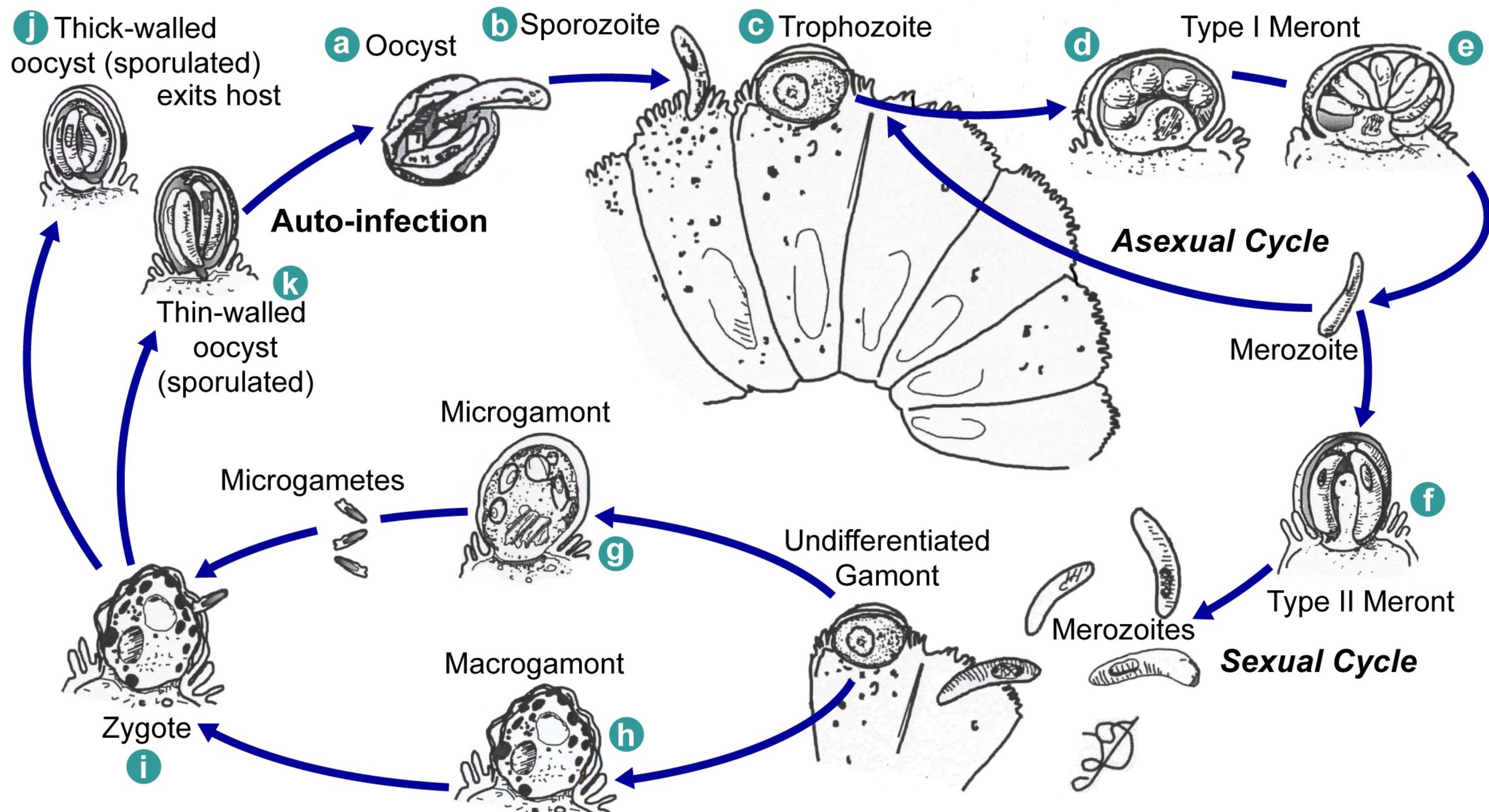
# Bacterial cell



# Bacterial pathogens

- Tuberculosis
- C. difficile
- Shigella
- S. aureus (MRSA)
- Cholera
- Y. pestis
- Typhoid
- Klebsiella

# Parasites

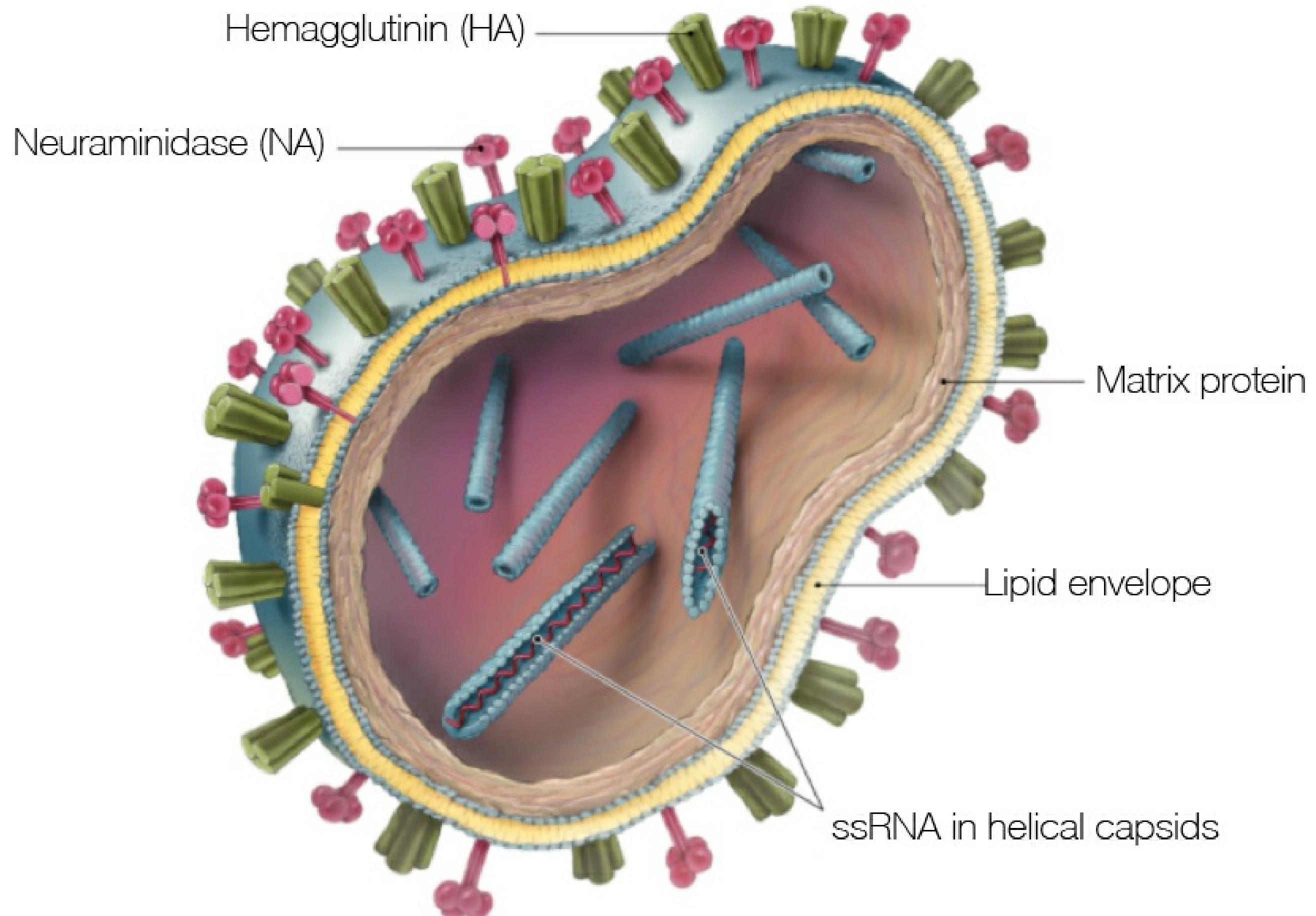


# Parasite lifecycle

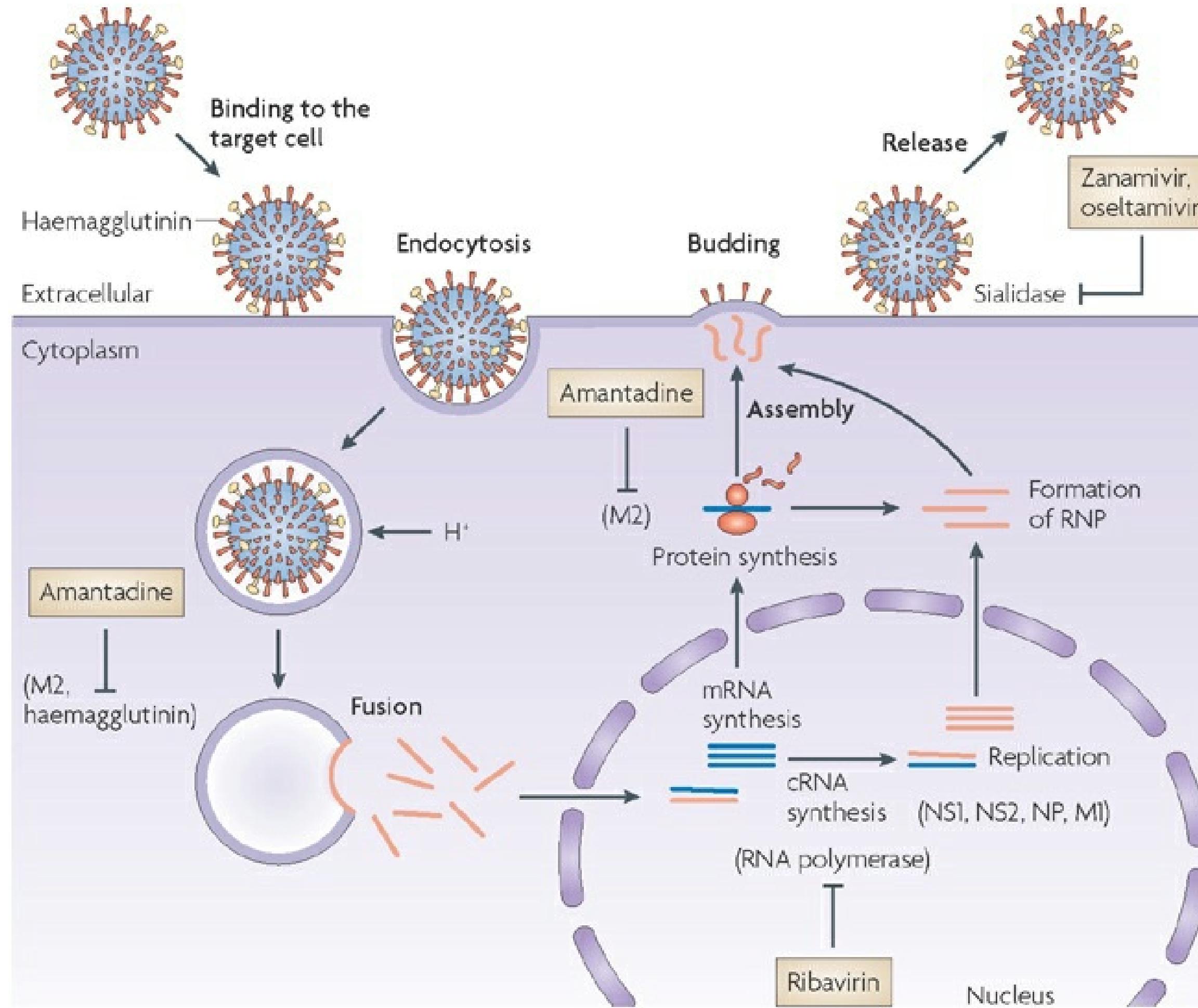
- Malaria
- Cryptosporidium
- Trypanosomes
- Giardia
- Leishmaniasis

# Influenza

# Influenza virion

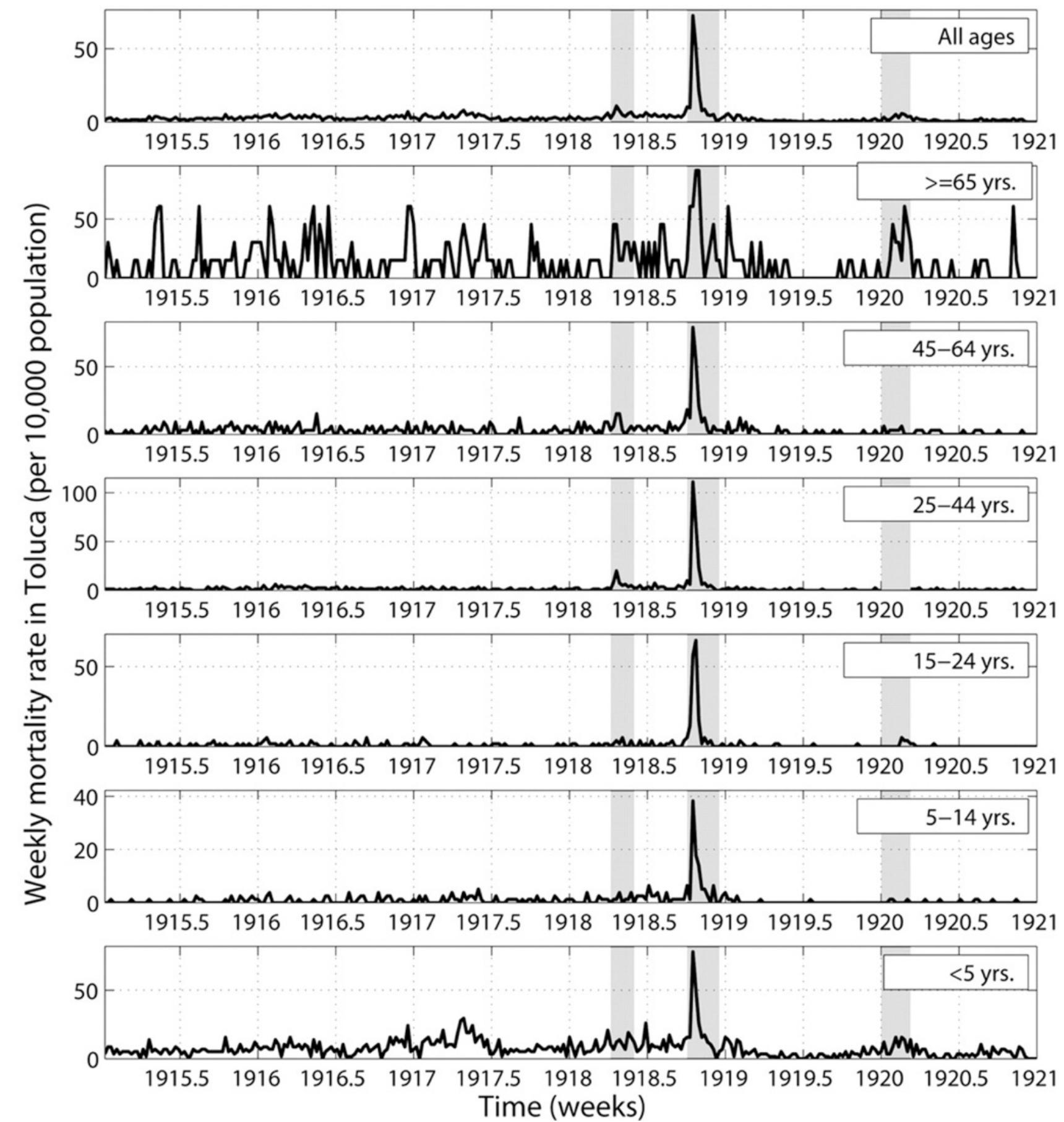


# Influenza life cycle



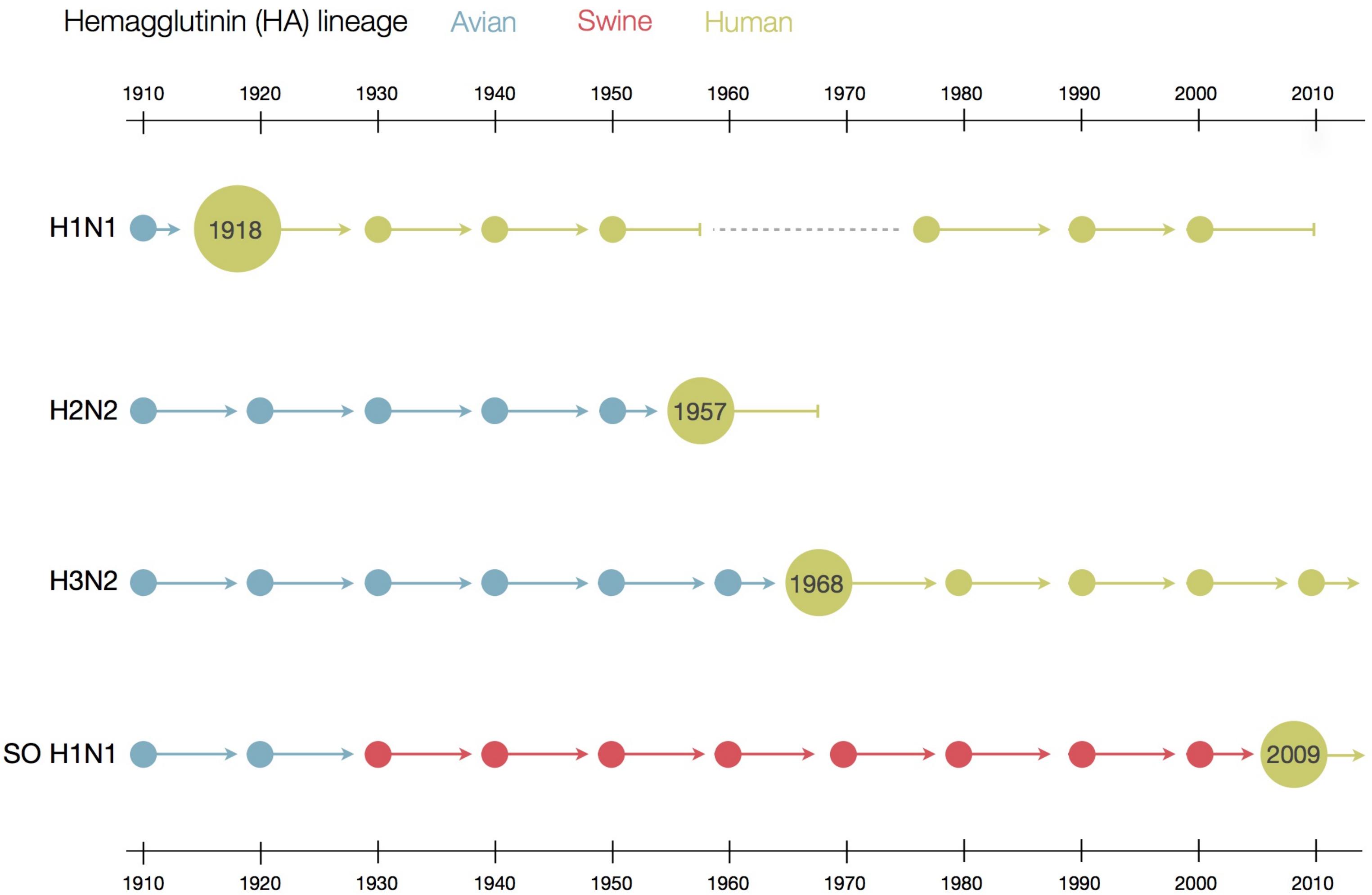


# 1918 "Spanish flu"

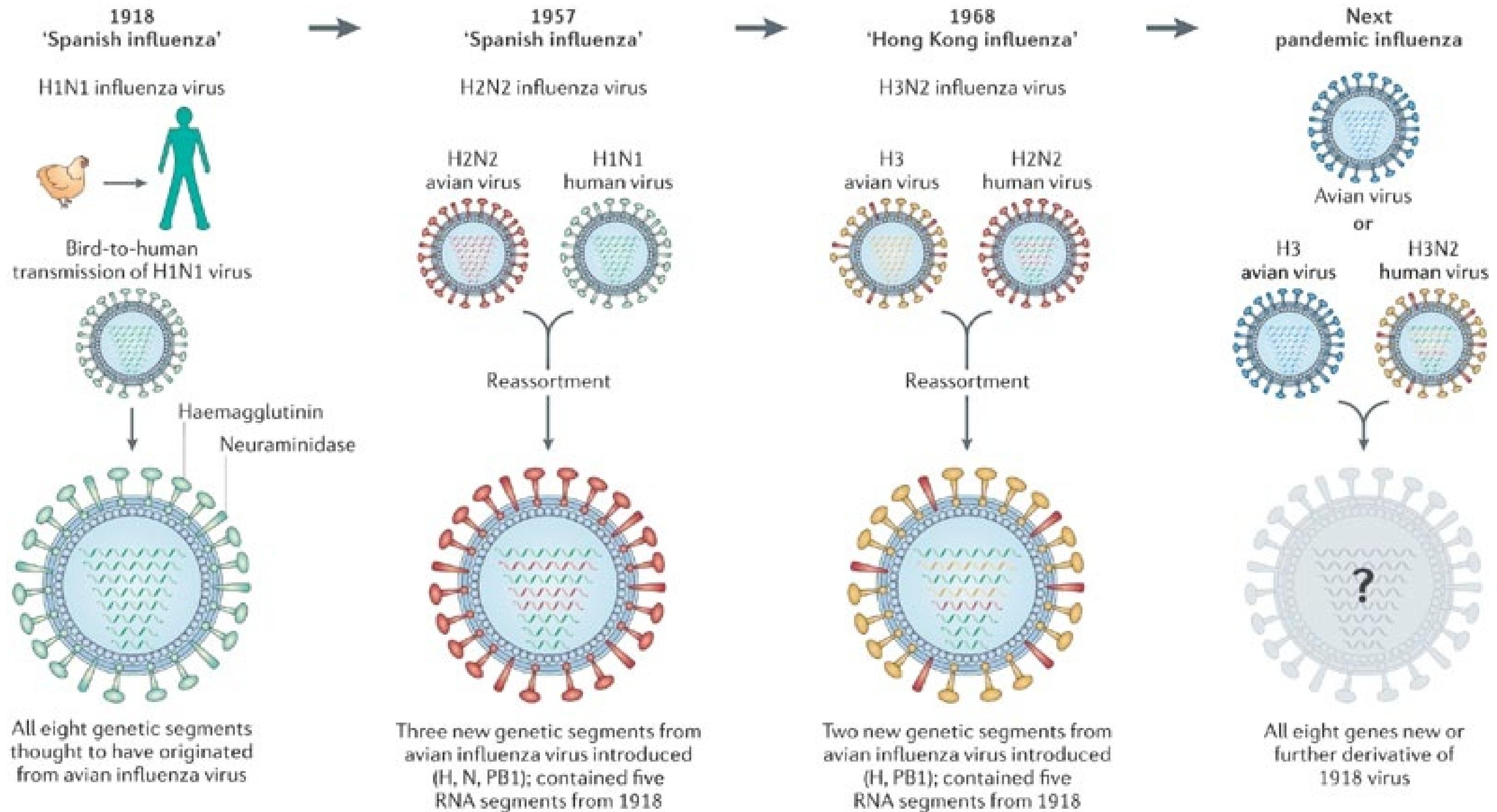




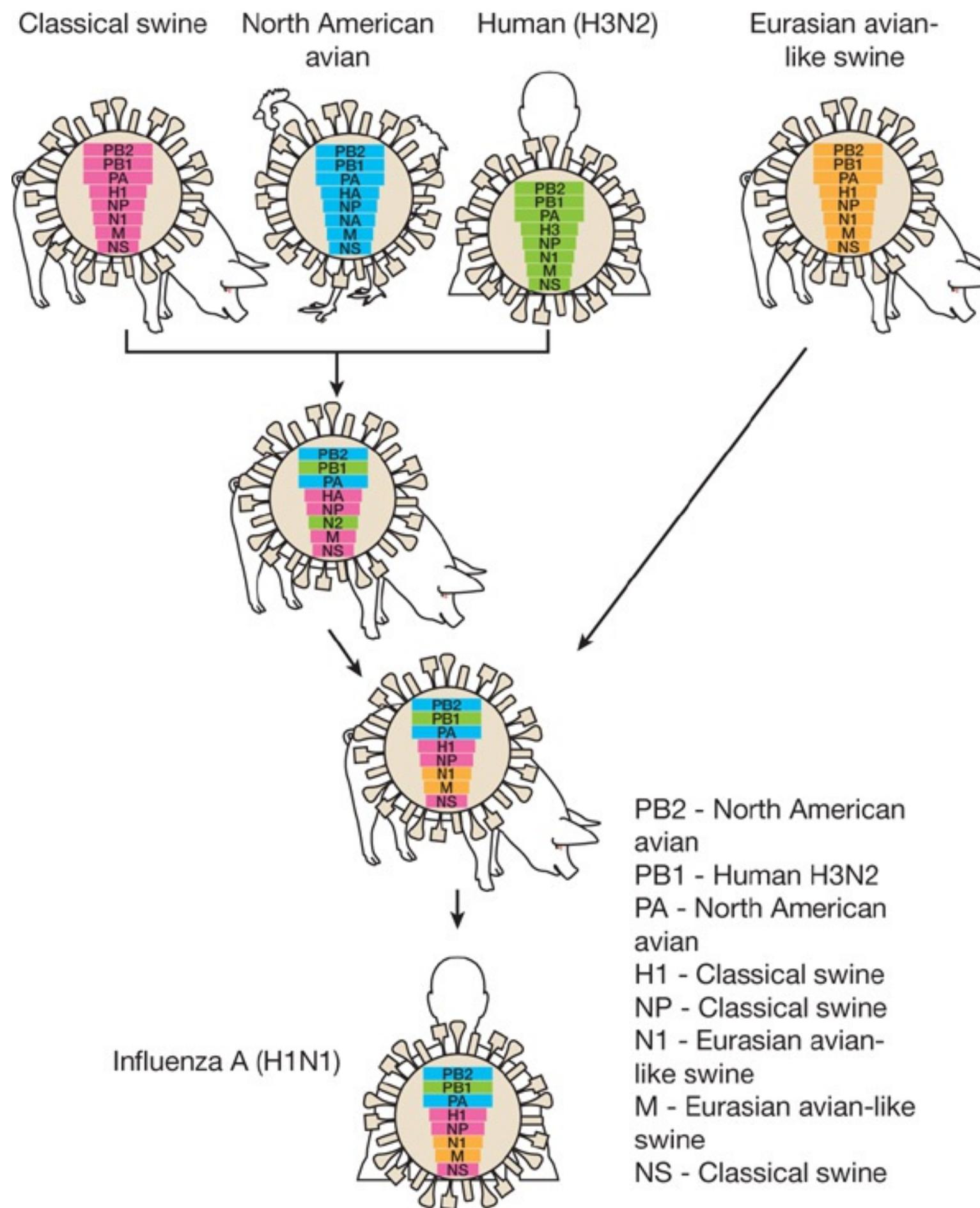
# Flu pandemics caused by host switch events



# Host switch events often occur through reassortment



# Host switch events often occur through reassortment



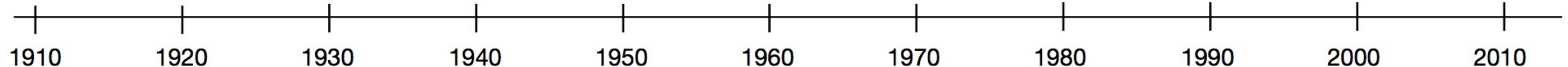
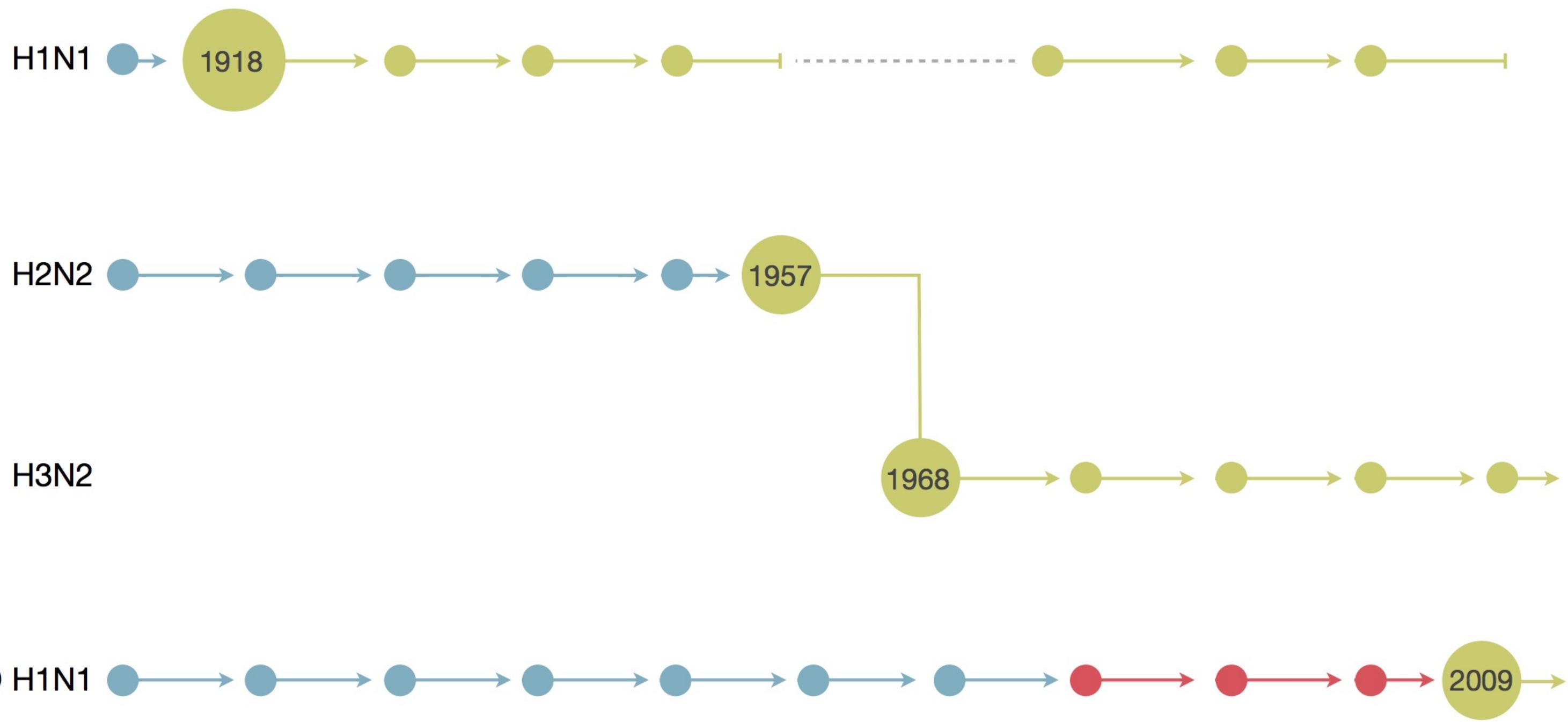
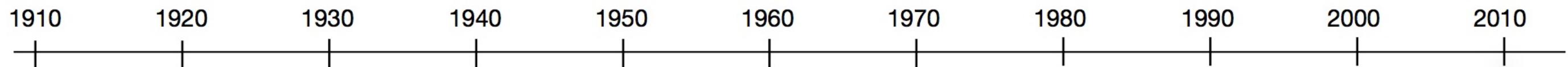
# Reassortment creates different histories

Neuraminidase (NA) lineage

Avian

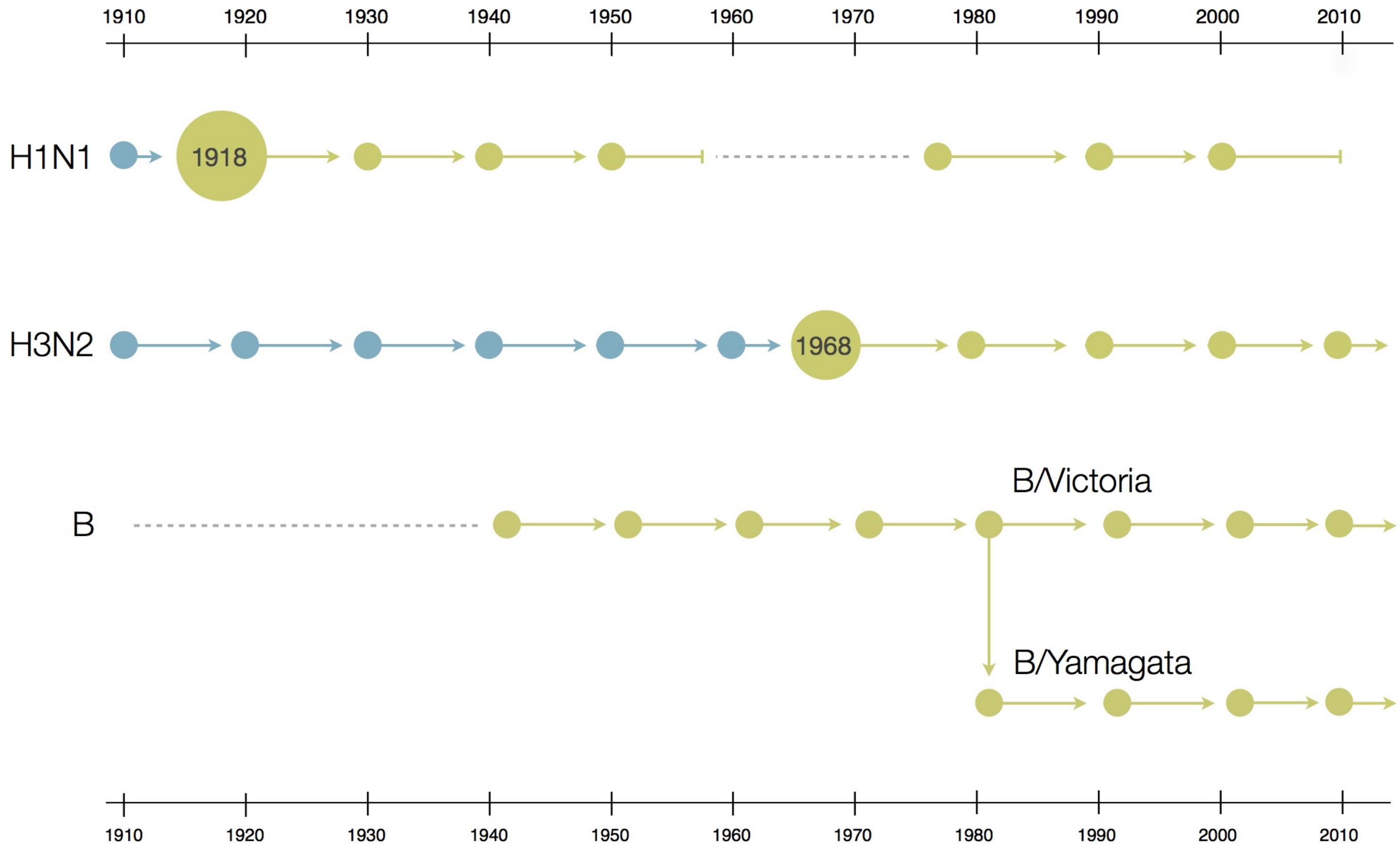
Swine

Human

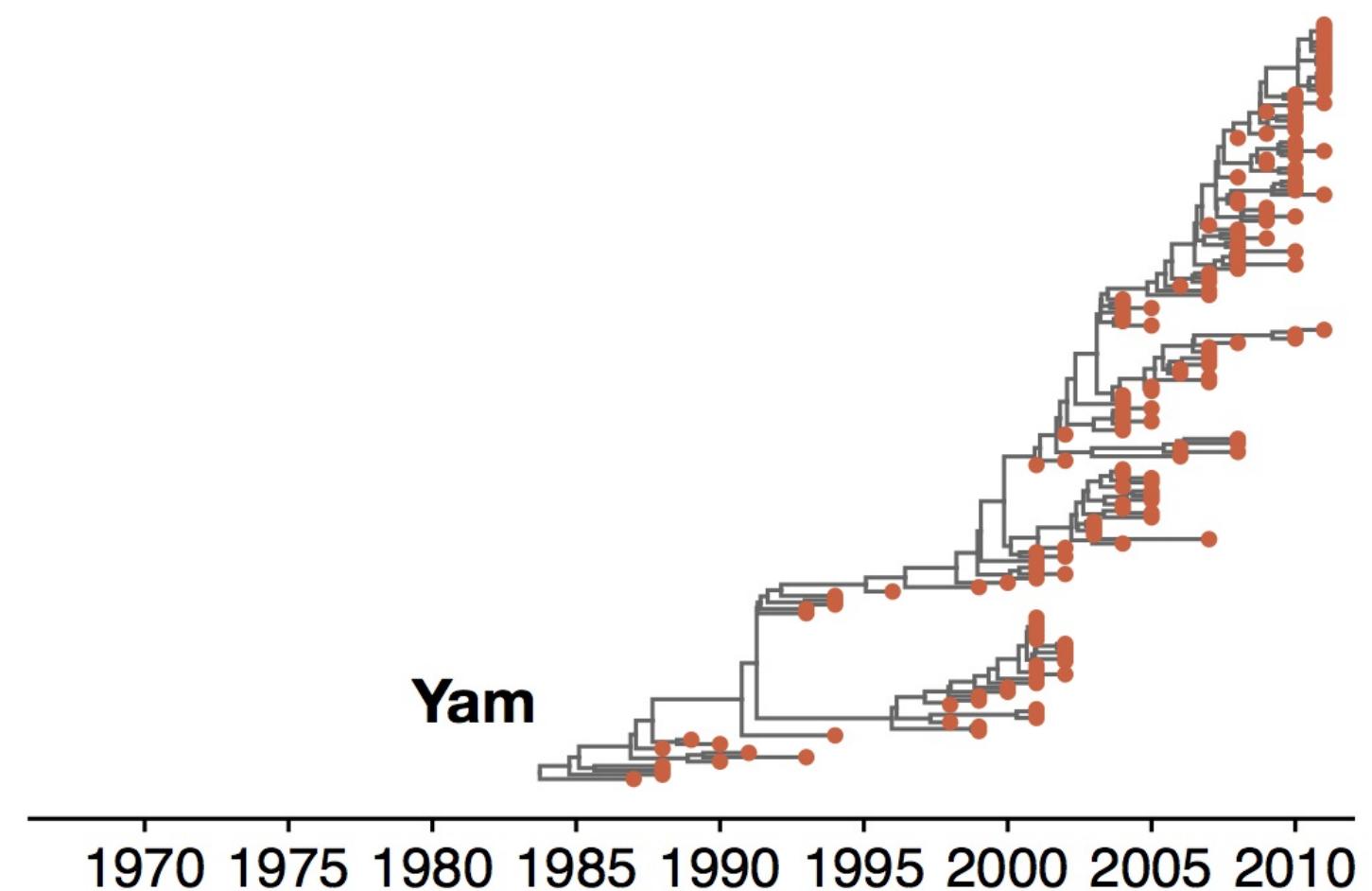
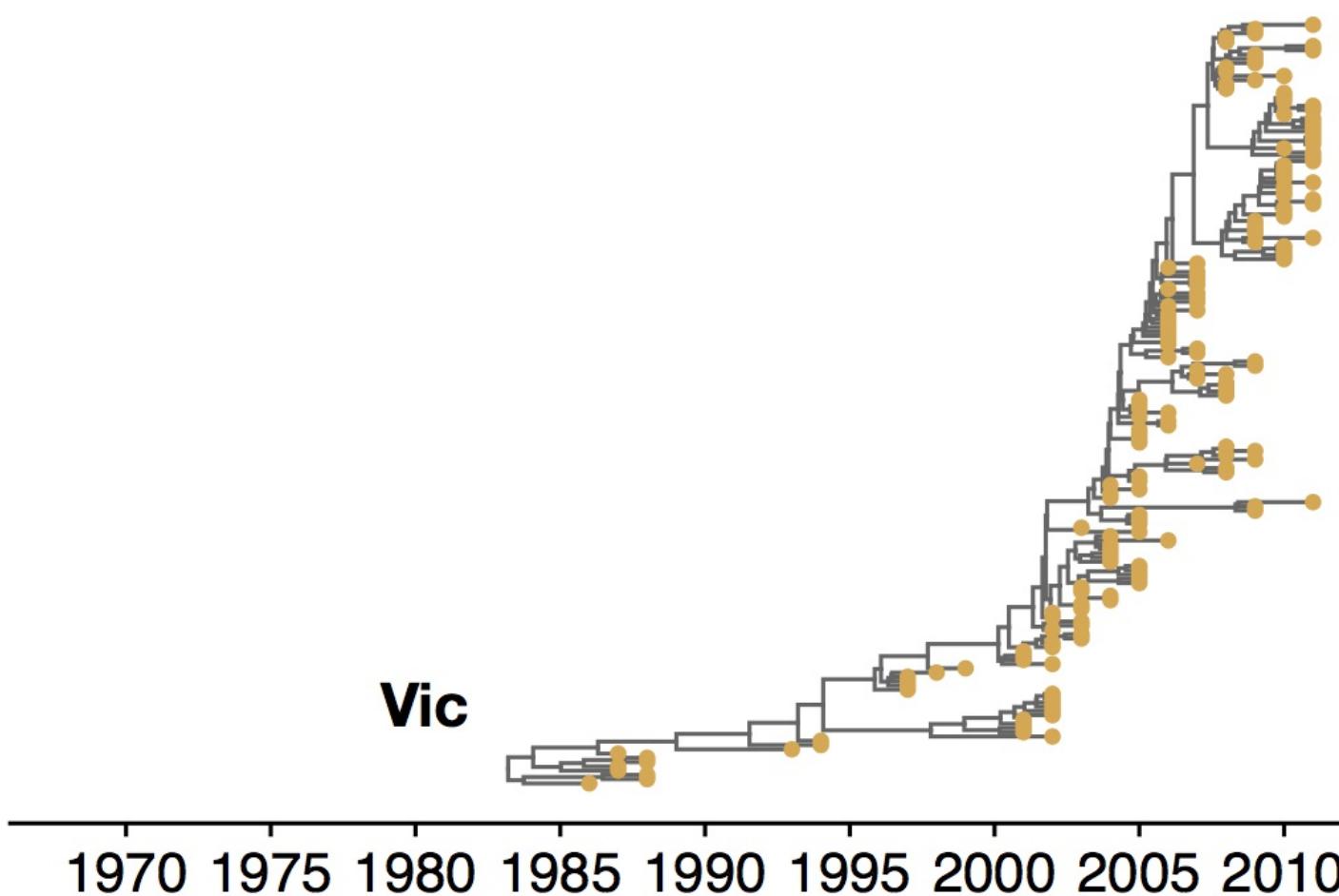
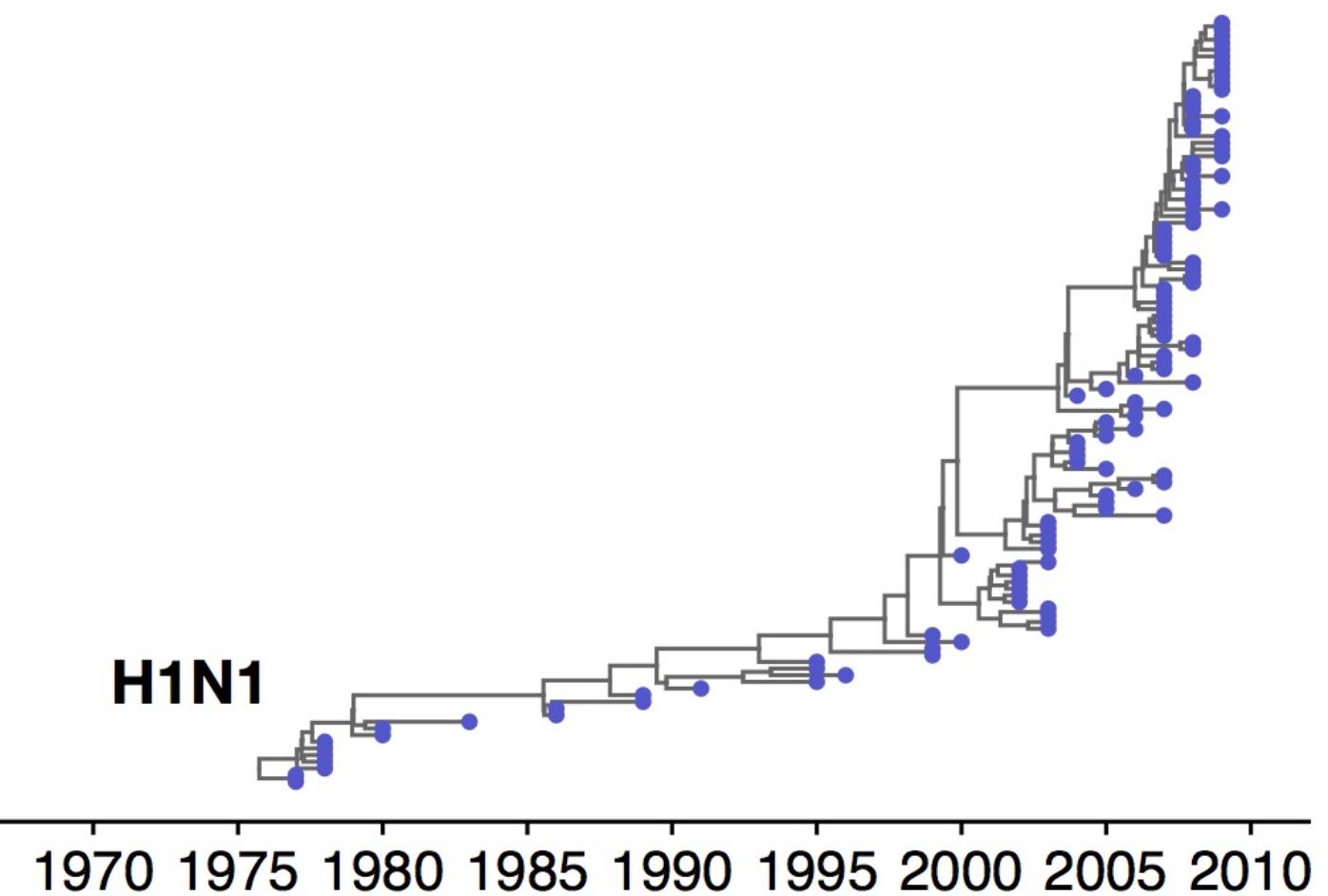
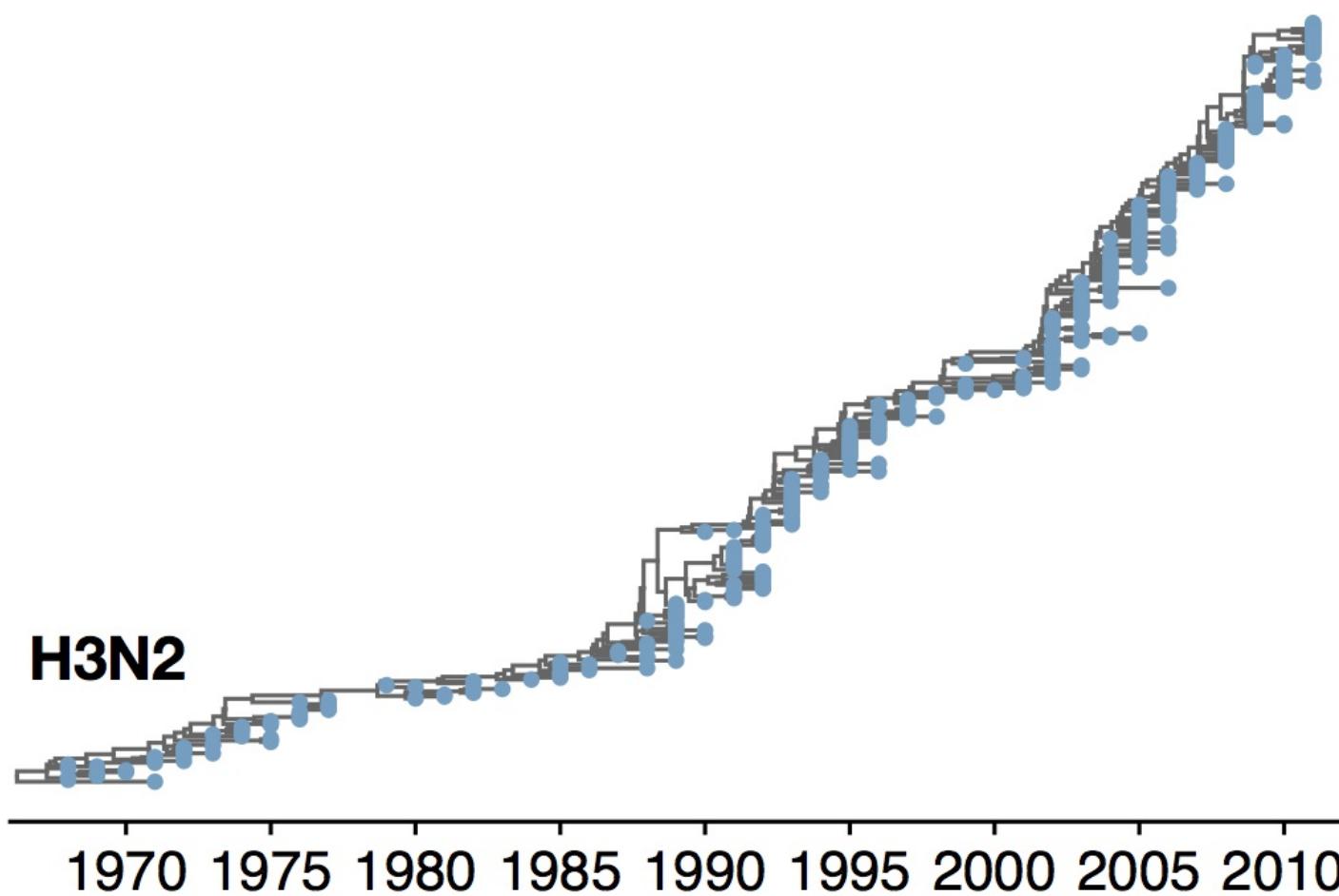


# Influenza B does not have pandemic potential

## Hemagglutinin (HA) lineage



# Phylogenetic trees of different influenza lineages



# nextflu

Show seasonal evolution of influenza viruses