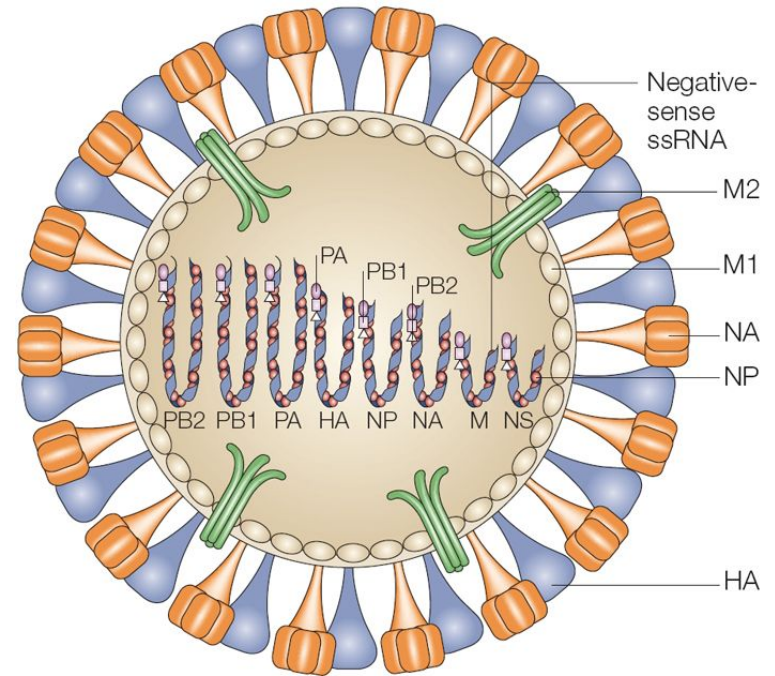
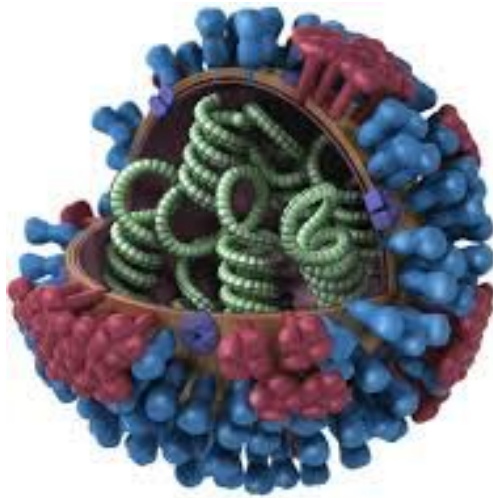


Pathogen evolution

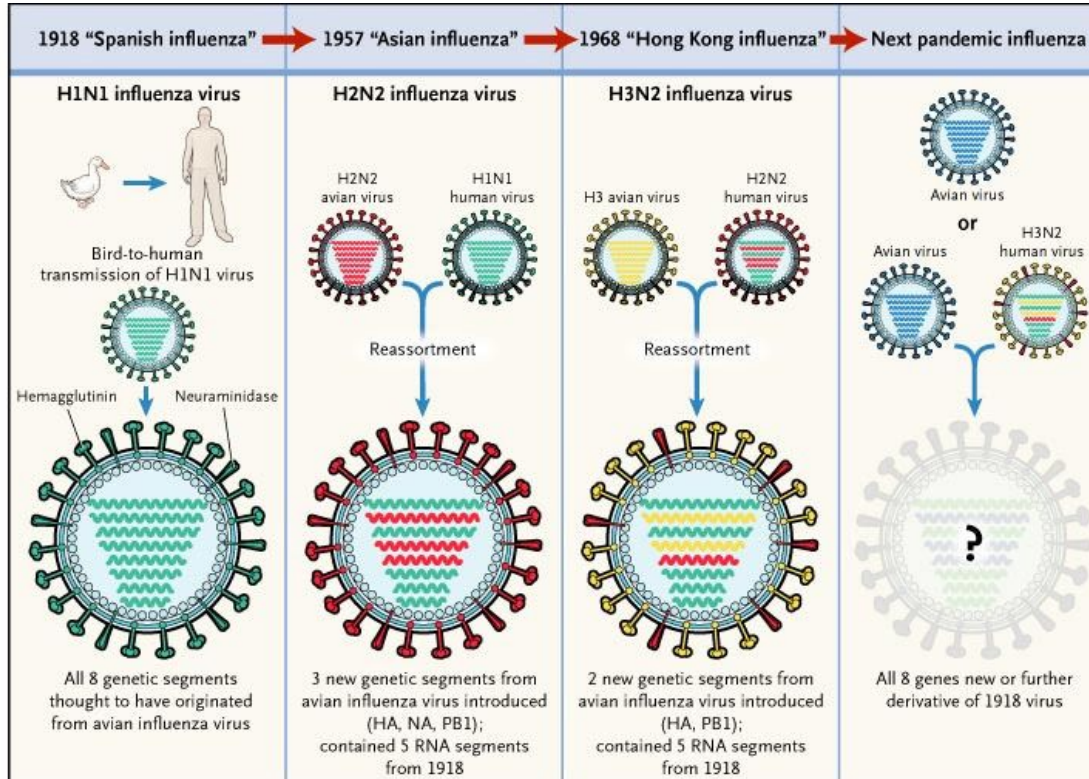
Introduction to Evolution and Scientific Inquiry

Dr. Stephanie J. Spielman; spielman@rowan.edu

Influenza



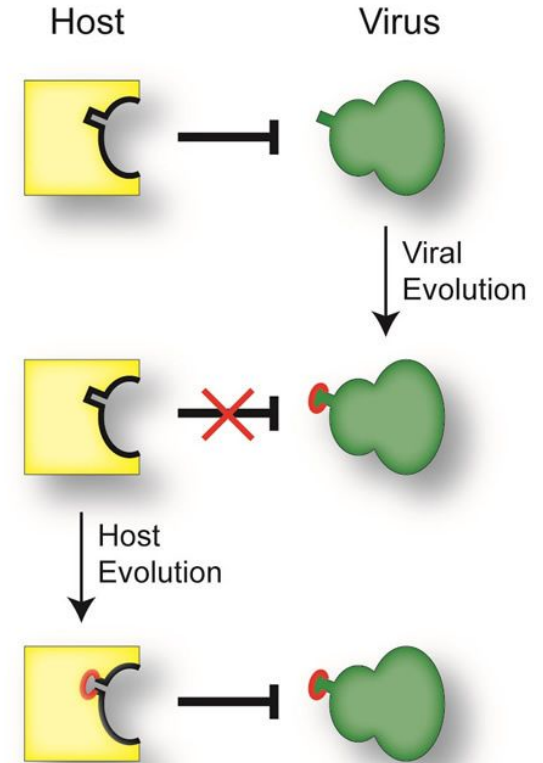
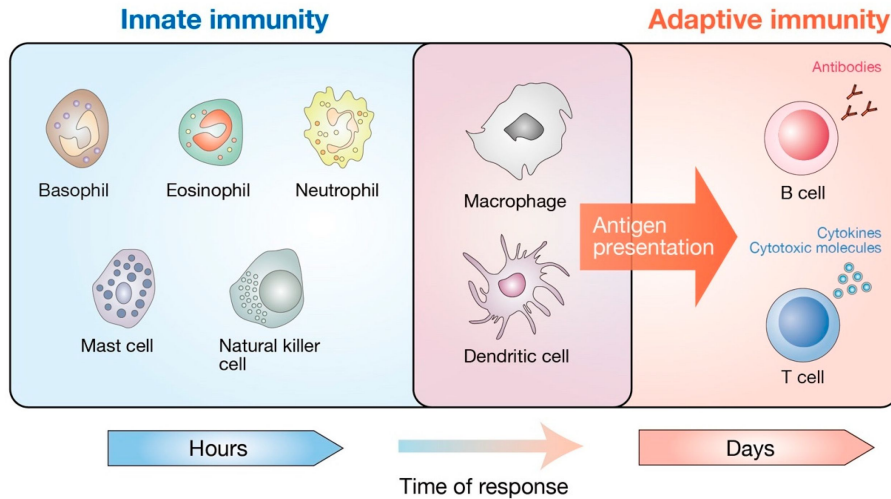
Emergence of novel influenza strains



Known hosts:

- *birds (mostly "poultry")*
- *pigs*
- *whales*
- *seals*
- *horses*
- *cats*
- *humans*

"Evolutionary arms race" with host





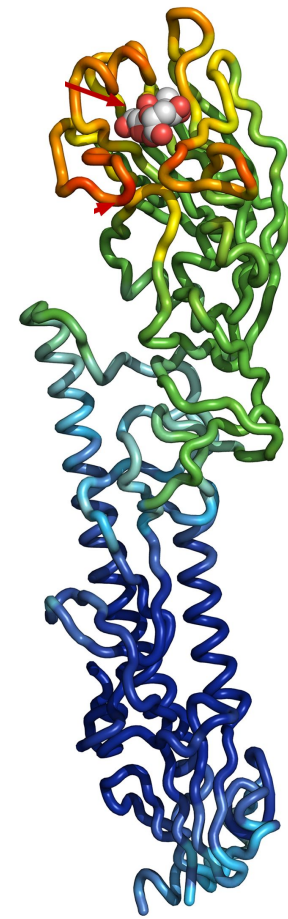
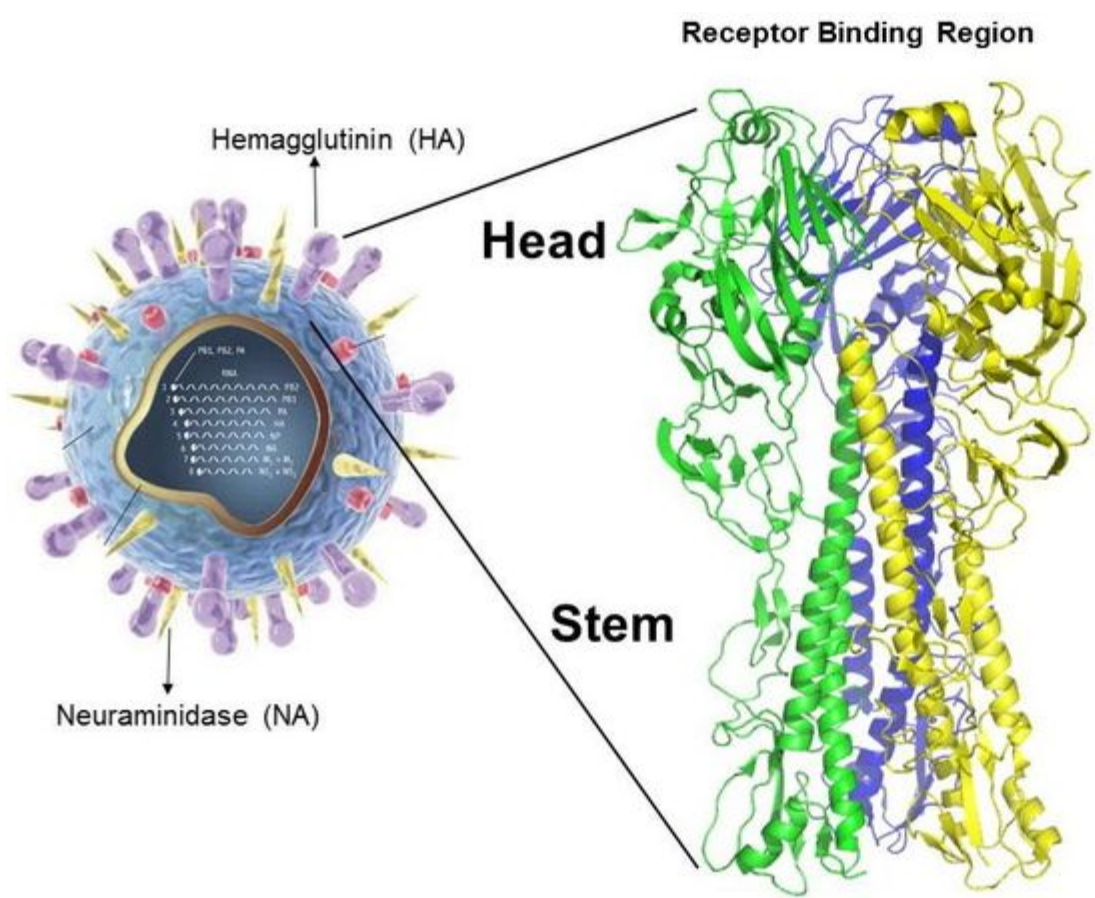
It takes all the running you can do, to
keep in the same place.

If you want to get somewhere else,
you must run at least twice as fast as
that.

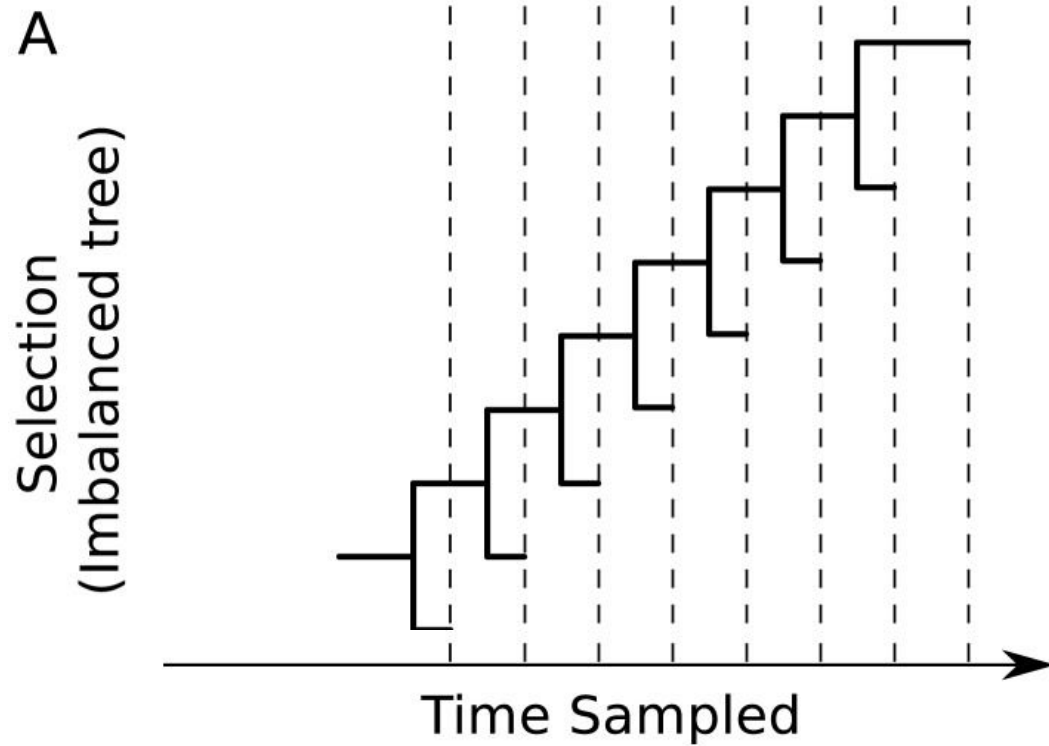
The Red Queen

Lewis Carroll
Through the Looking Glass



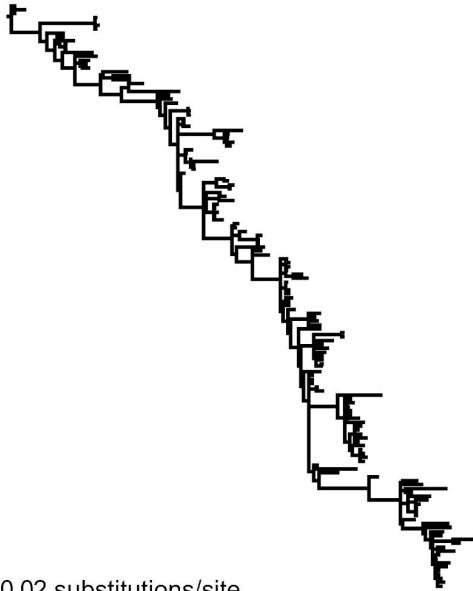


Host immune system → selection pressure on virus

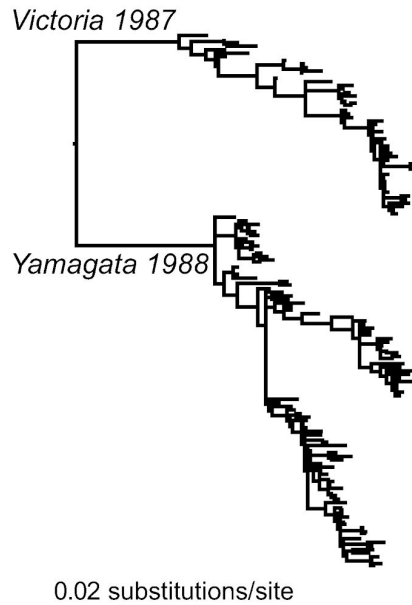


Phylogeny of flu therefore tends to look like a ladder

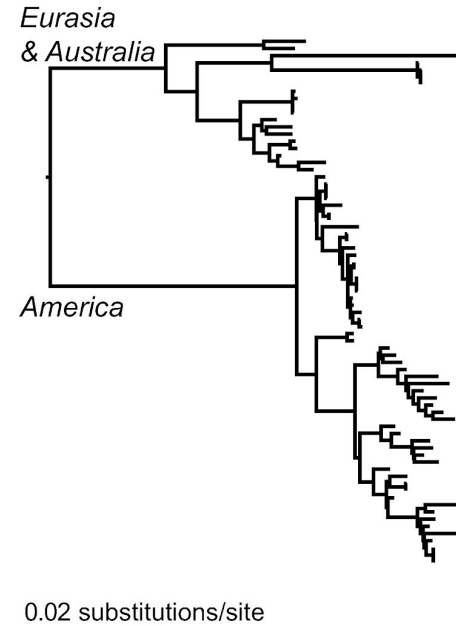
Influenza A virus (H3N2)



Influenza B virus



H4 avian influenza virus



A phylogeny of flu virus **hemagglutinin** genes:
The 1968 human flu appears to have acquired its
hemagglutinin gene from a bird flu strain

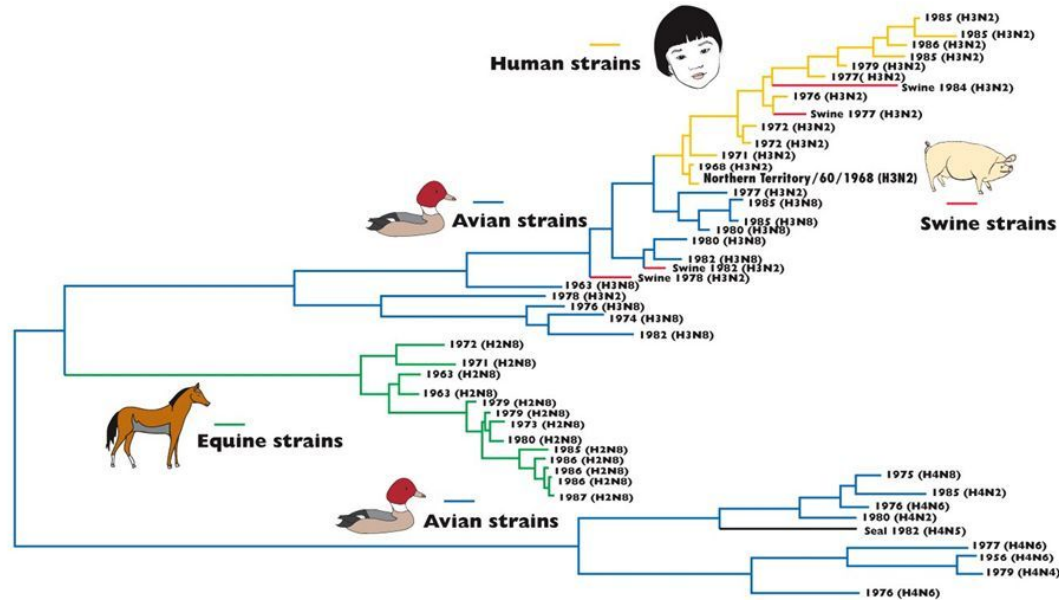
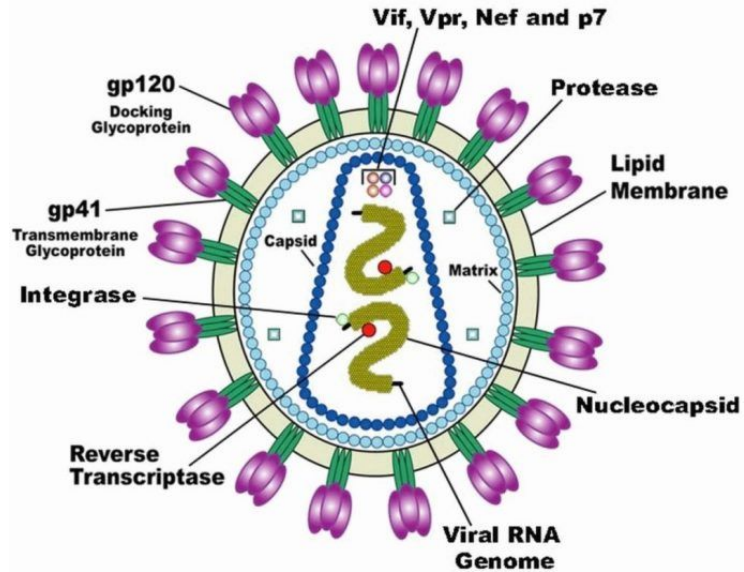


Figure 14-8 Evolutionary Analysis, 4/e
© 2007 Pearson Prentice Hall, Inc.

The phylogeography of HIV



ANNOTATED GENOME OF HIV

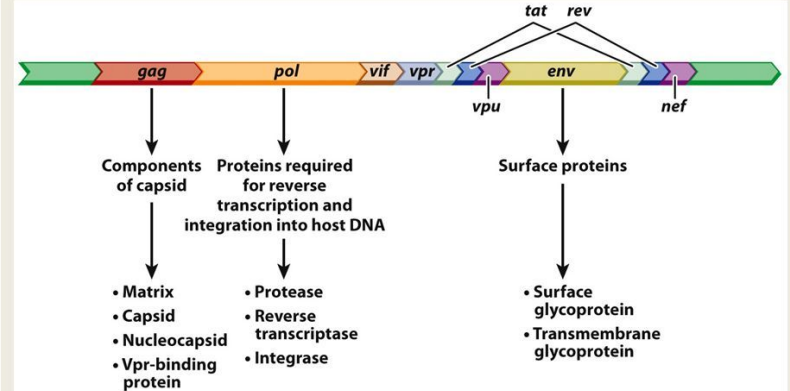
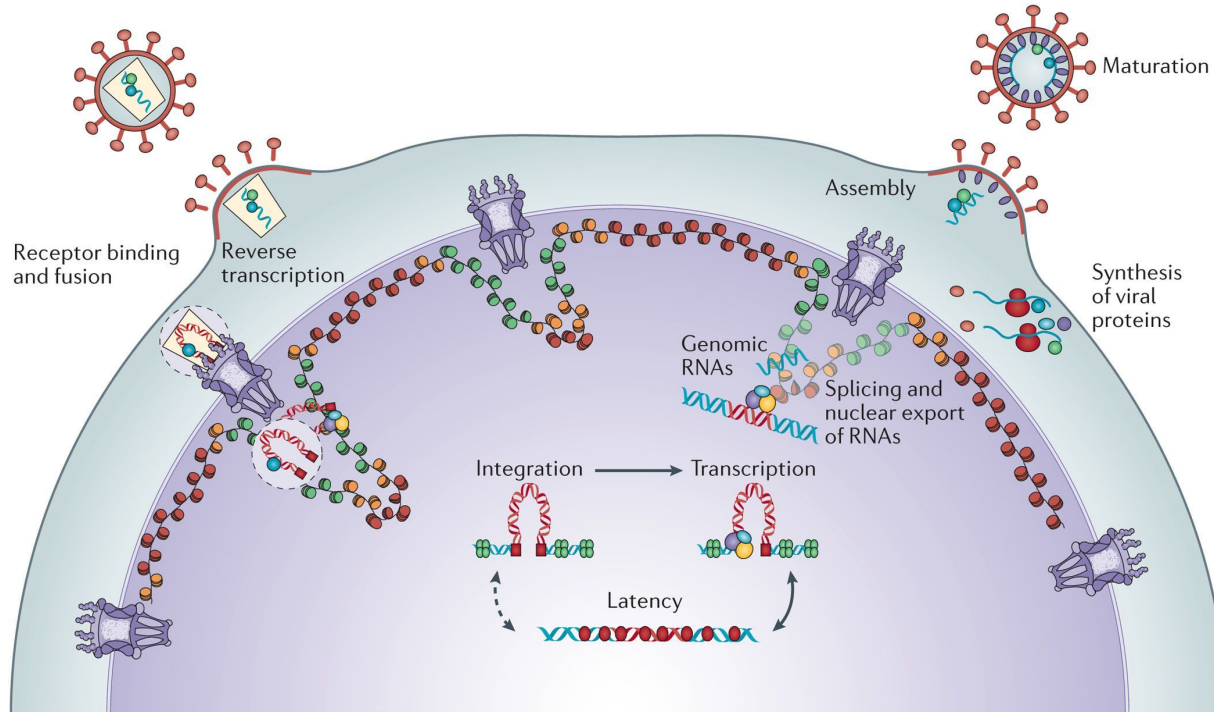
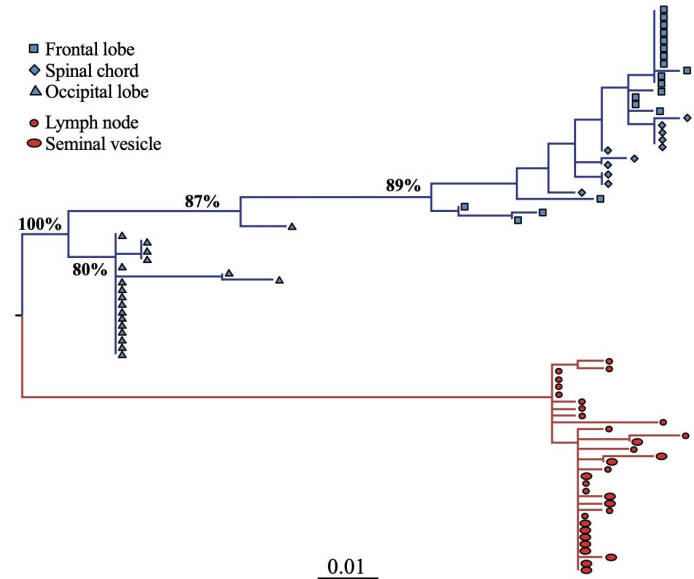
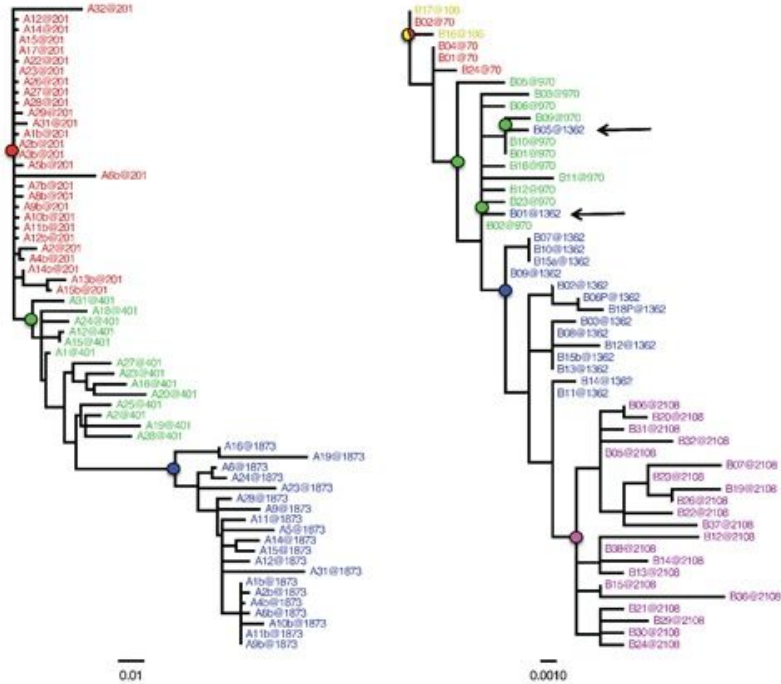


Figure 13.7
Biology: How Life Works
© 2014 W. H. Freeman and Company

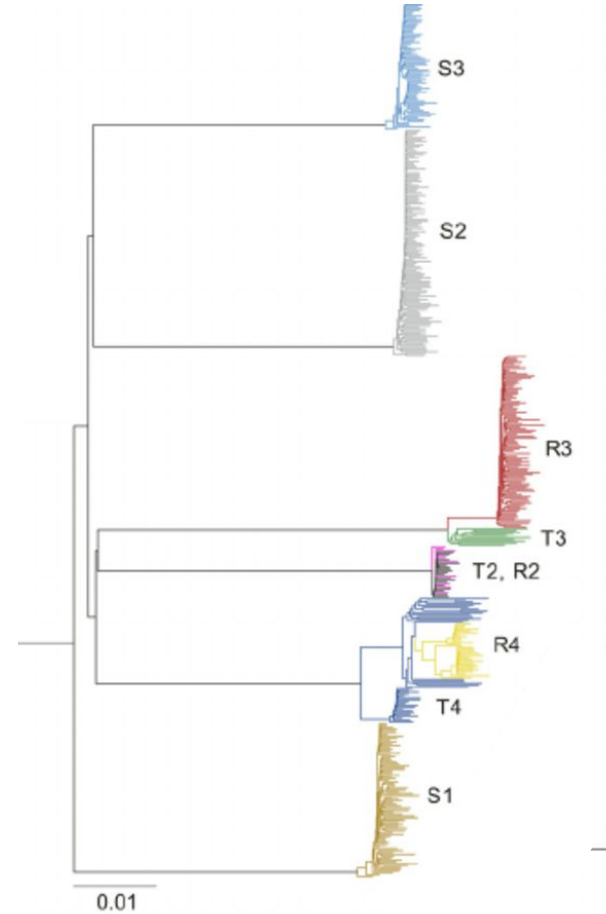
Retroviruses have very high mutation rates, and more...



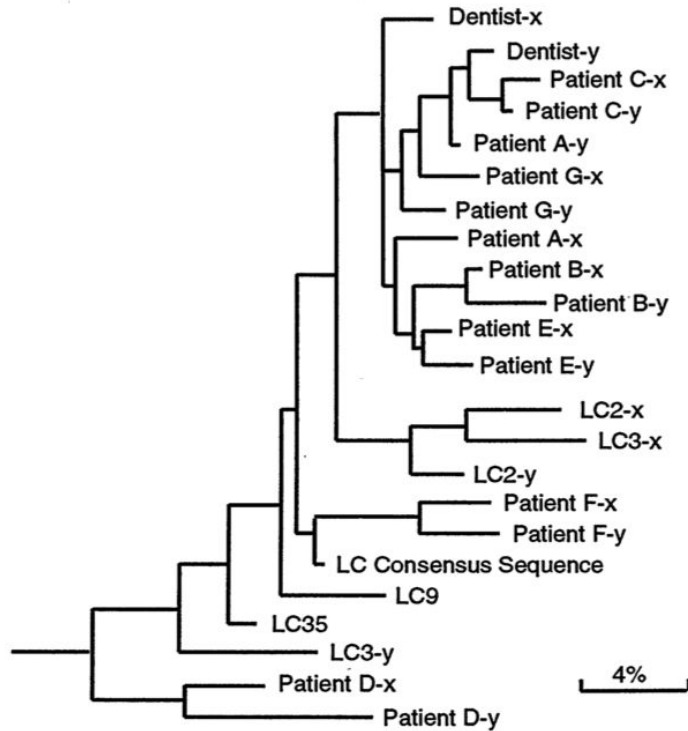
INTRAhost phylogenies



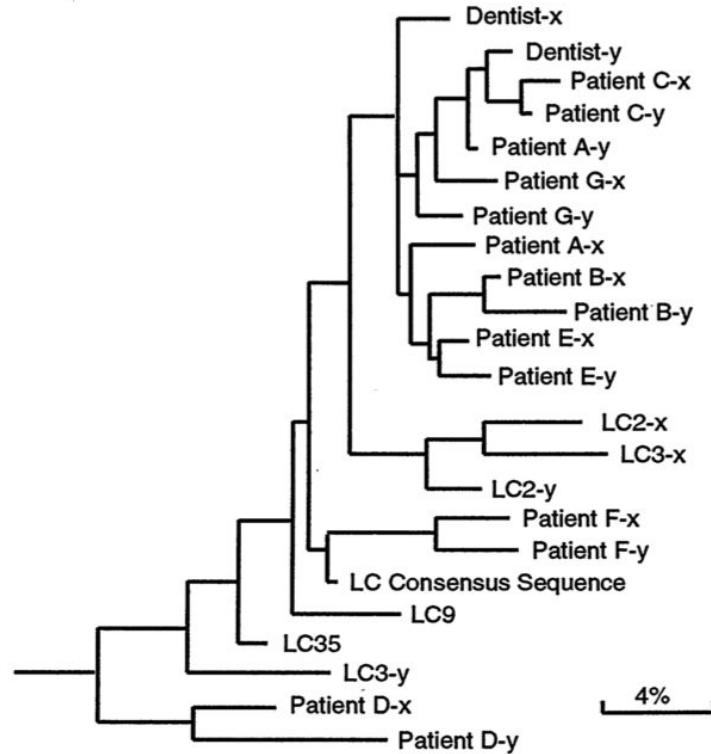
Inter/intra-host phylogeny



Phylogenetic Forensics: the FL dentist.....

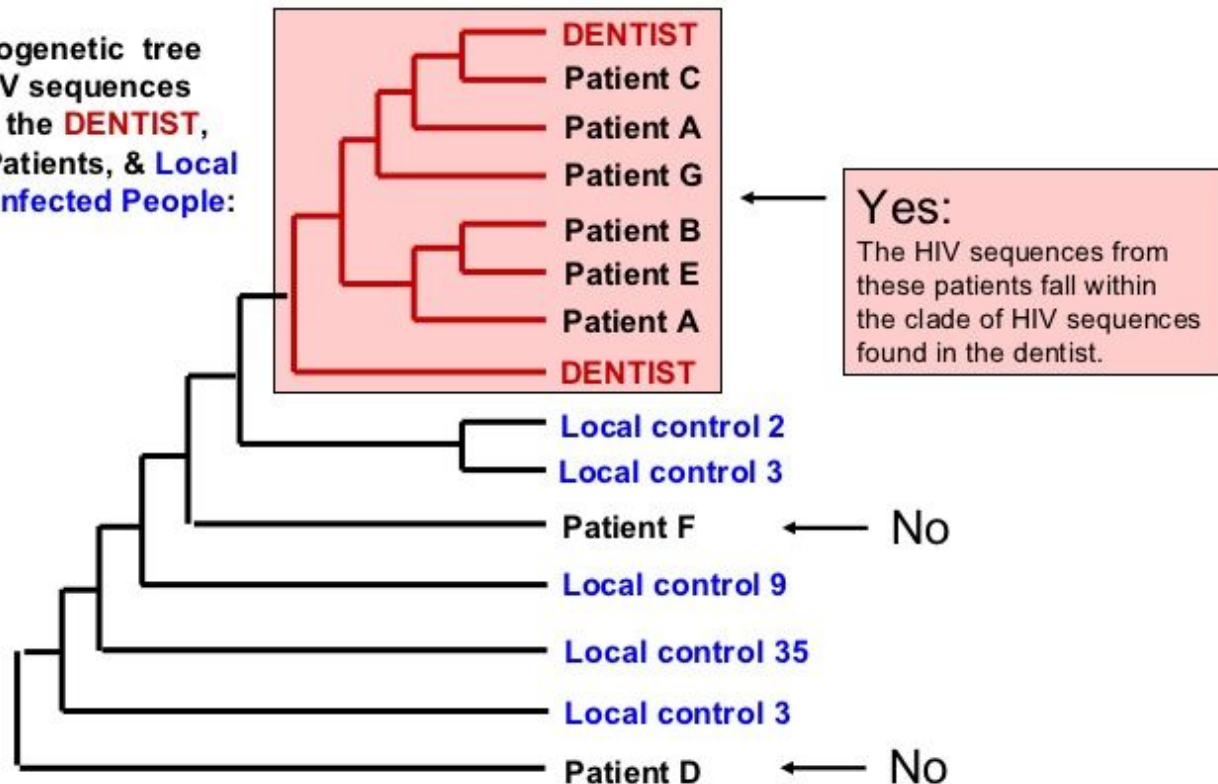


Phylogenetic Forensics: the FL dentist.....

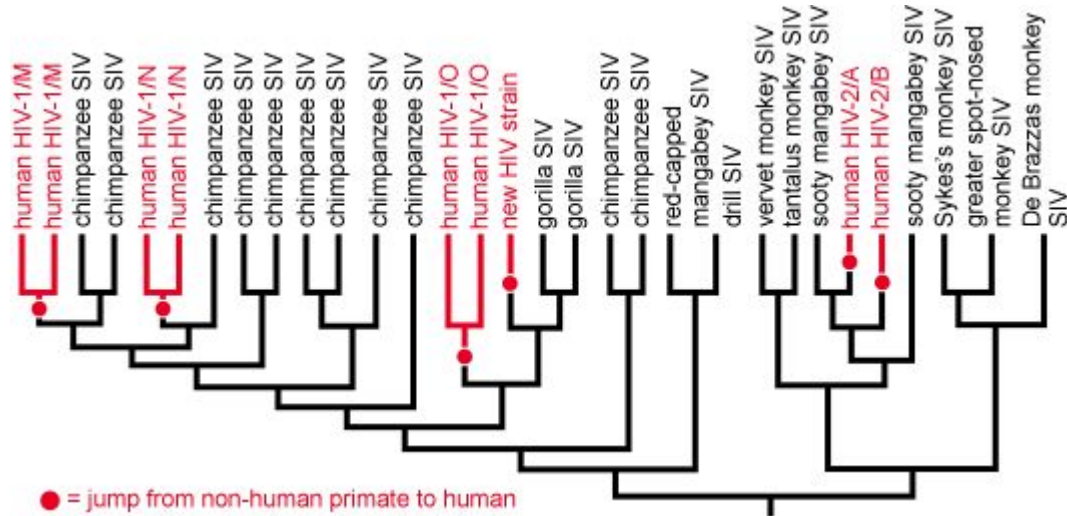


Did the *Florida Dentist* infect his patients with HIV?

Phylogenetic tree of HIV sequences from the **DENTIST**, his Patients, & **Local HIV-infected People**:

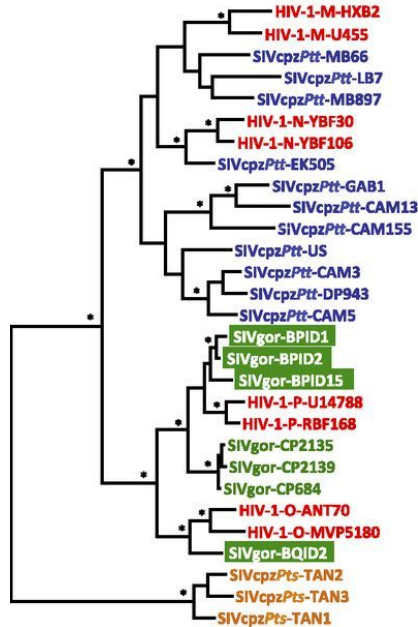


A phylogeny of human HIV subtypes and close SIV relatives

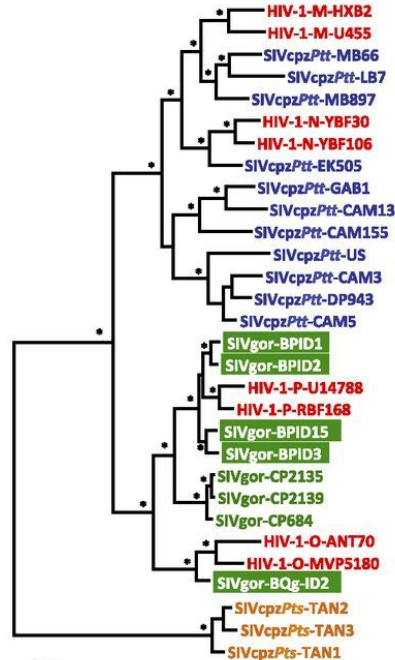


Dynamics of SIV: Group O/P reservoir in gorillas

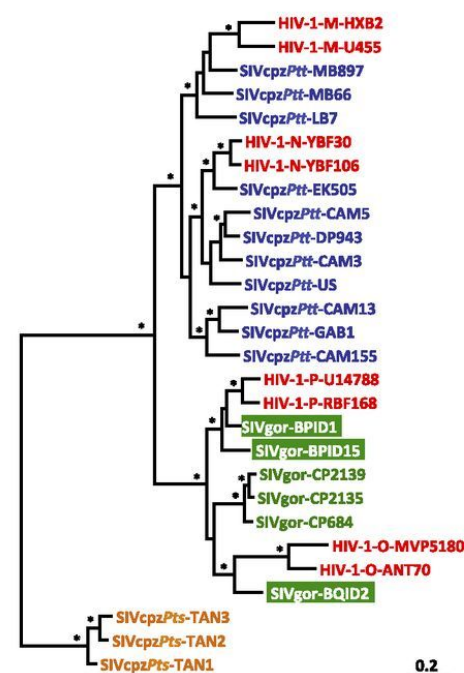
A Gag (488aa)



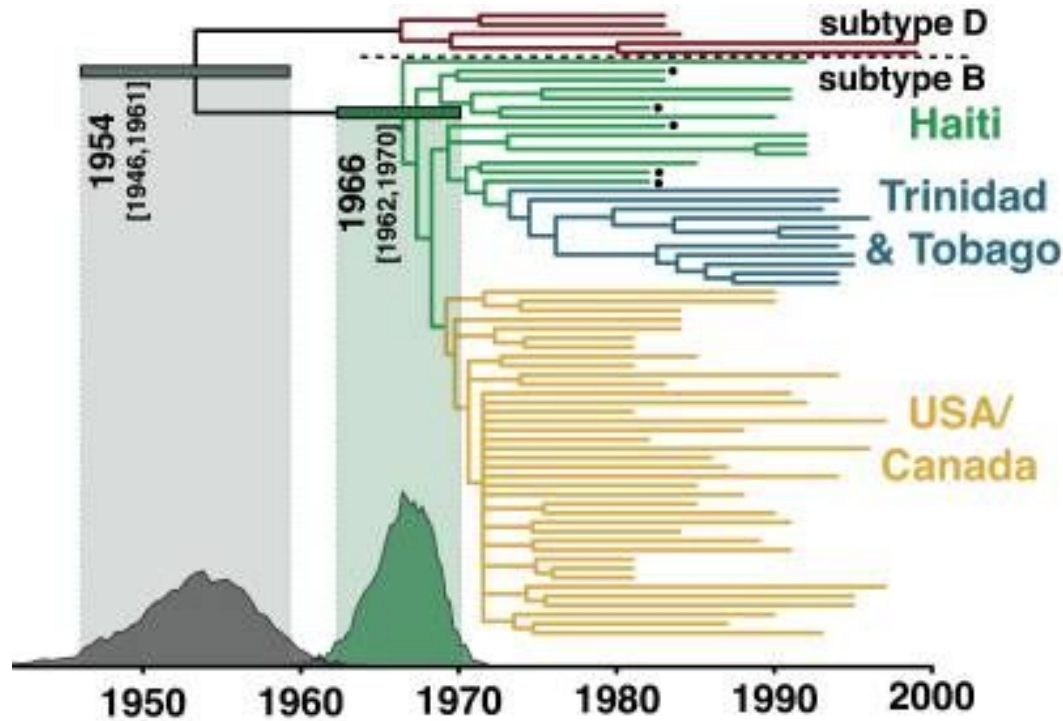
B Pol (927aa)



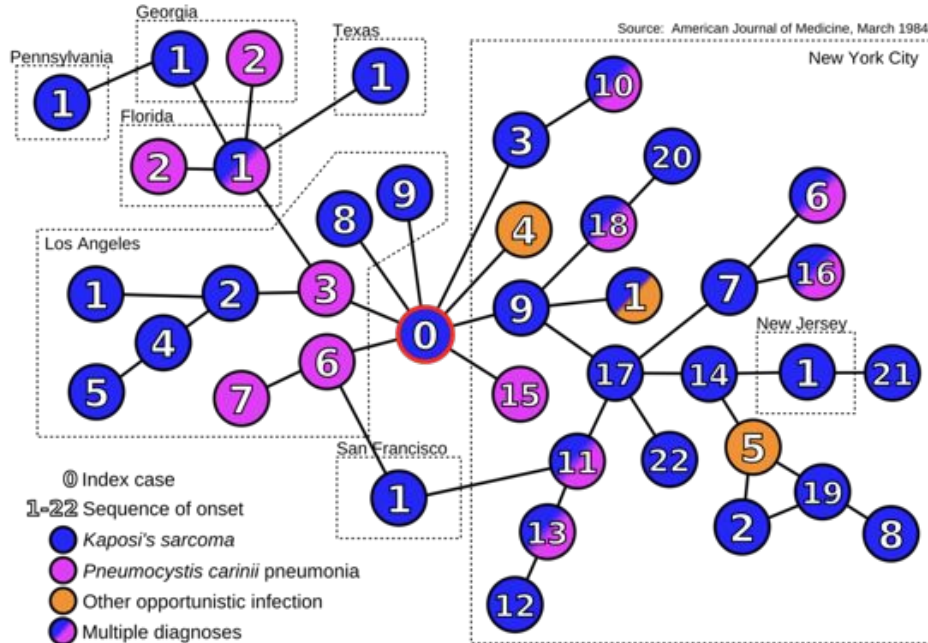
C Env/Nef (854aa)



How did HIV get to the United States?



HIV in the United States: "Patient 0"



Auerbach, David M., et al. (1984) Cluster of Cases of the Acquired Immune Deficiency Syndrome. *The American Journal of Medicine*.
http://ac.els-cdn.com/0002934384006685/1-s2.0-0002934384006685-main.pdf?_tid=575f8d1c-1899-41e7-b809-00000a0b35e8&acdnat=1491243433_290905aa956409af0e72f8fa23c6c156

Was Patient 0 the first American with HIV?

