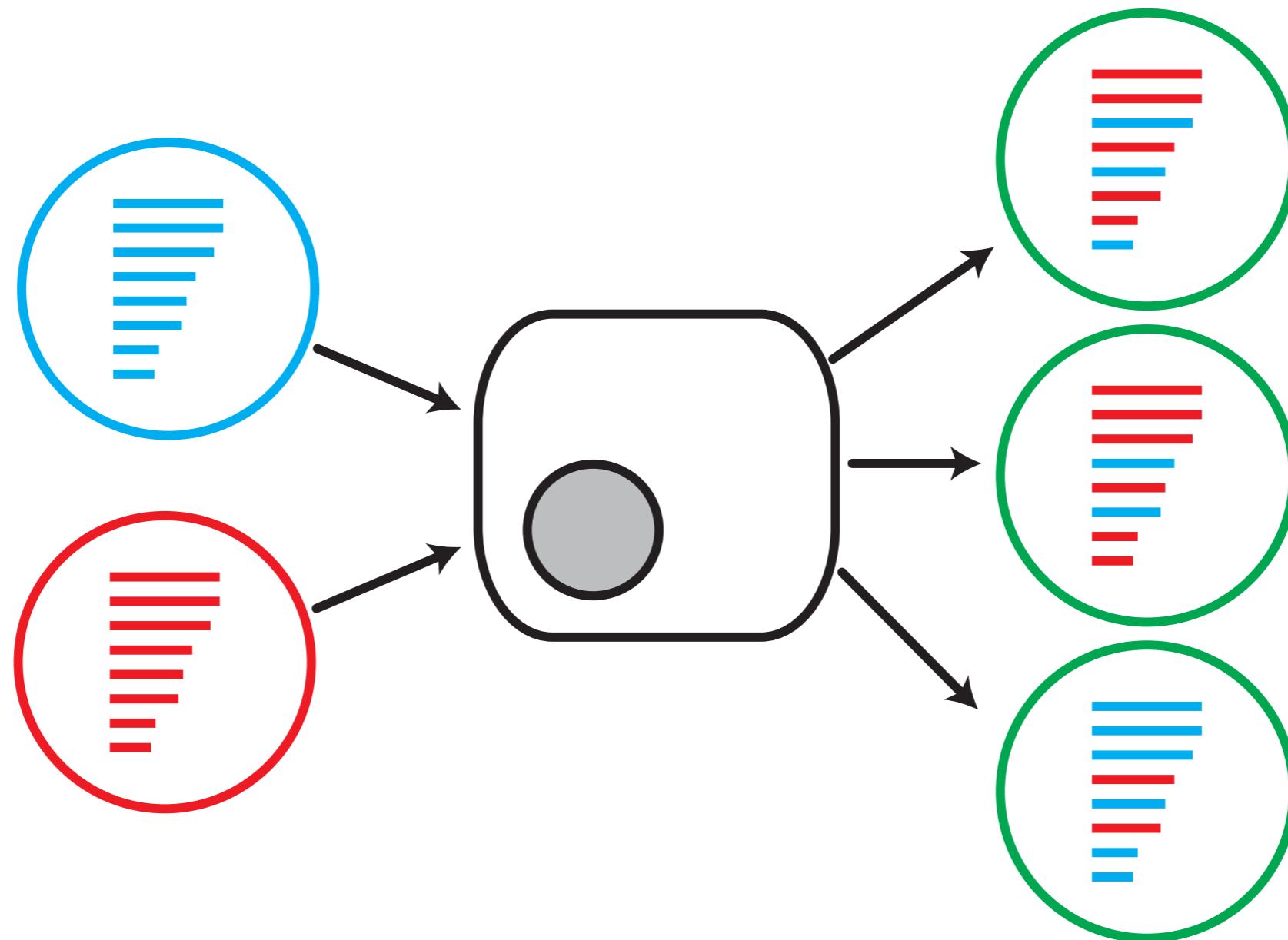


# Reassortment Primes Influenza for Host Group Switches

Eric J. Ma  
CEIRS 2015 Annual Meeting

# How important is reassortment for host switching?



# A comprehensive dataset analysis is necessary

**16,653** Number of isolates in dataset

**1980-2014** Date range of sequences

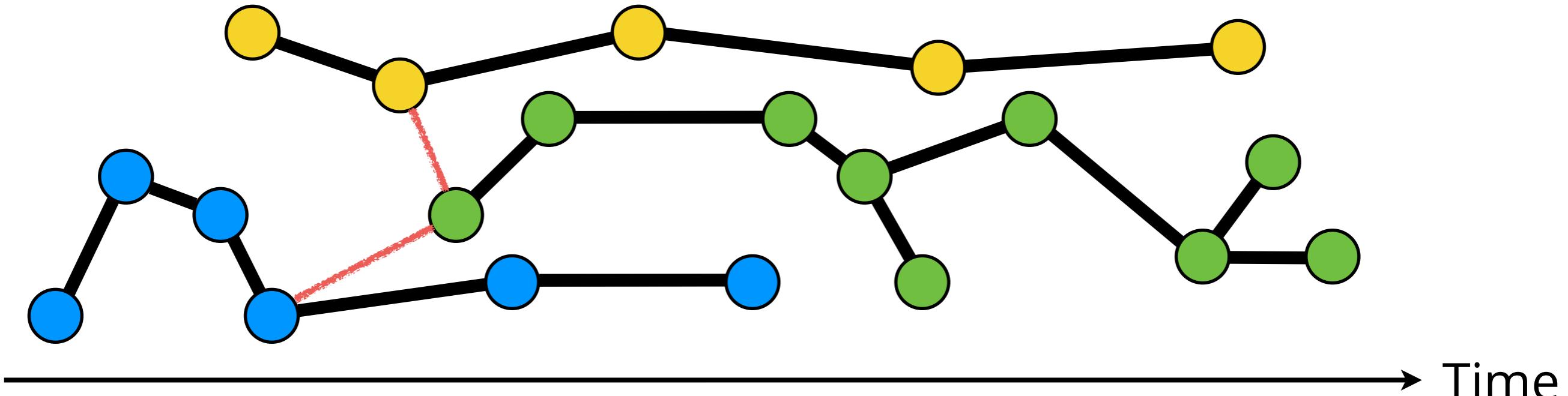
**2106** Reassortment events

All data were sourced from the  
**Influenza Research Database**

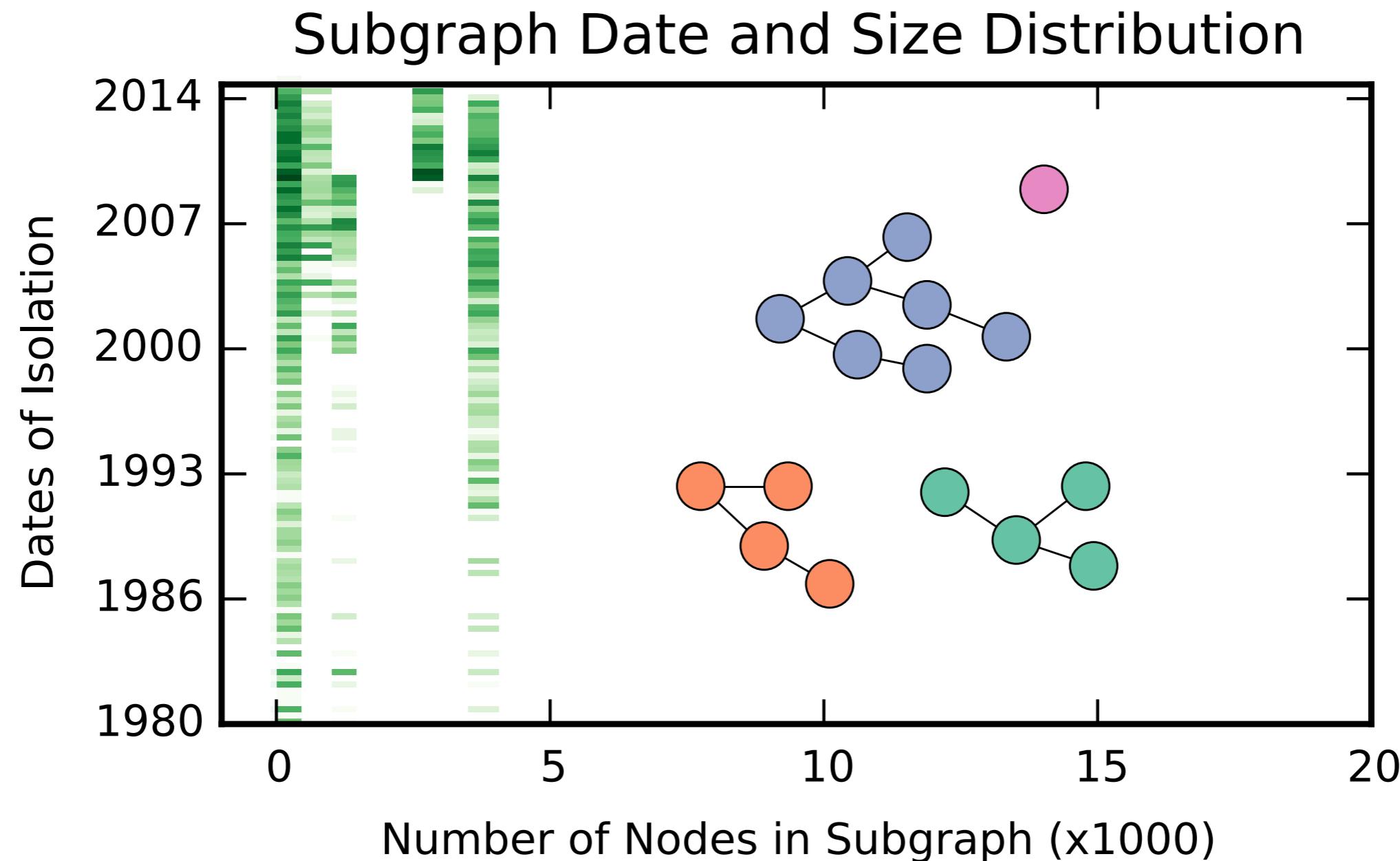
# Method

● ● ● Viral Isolate

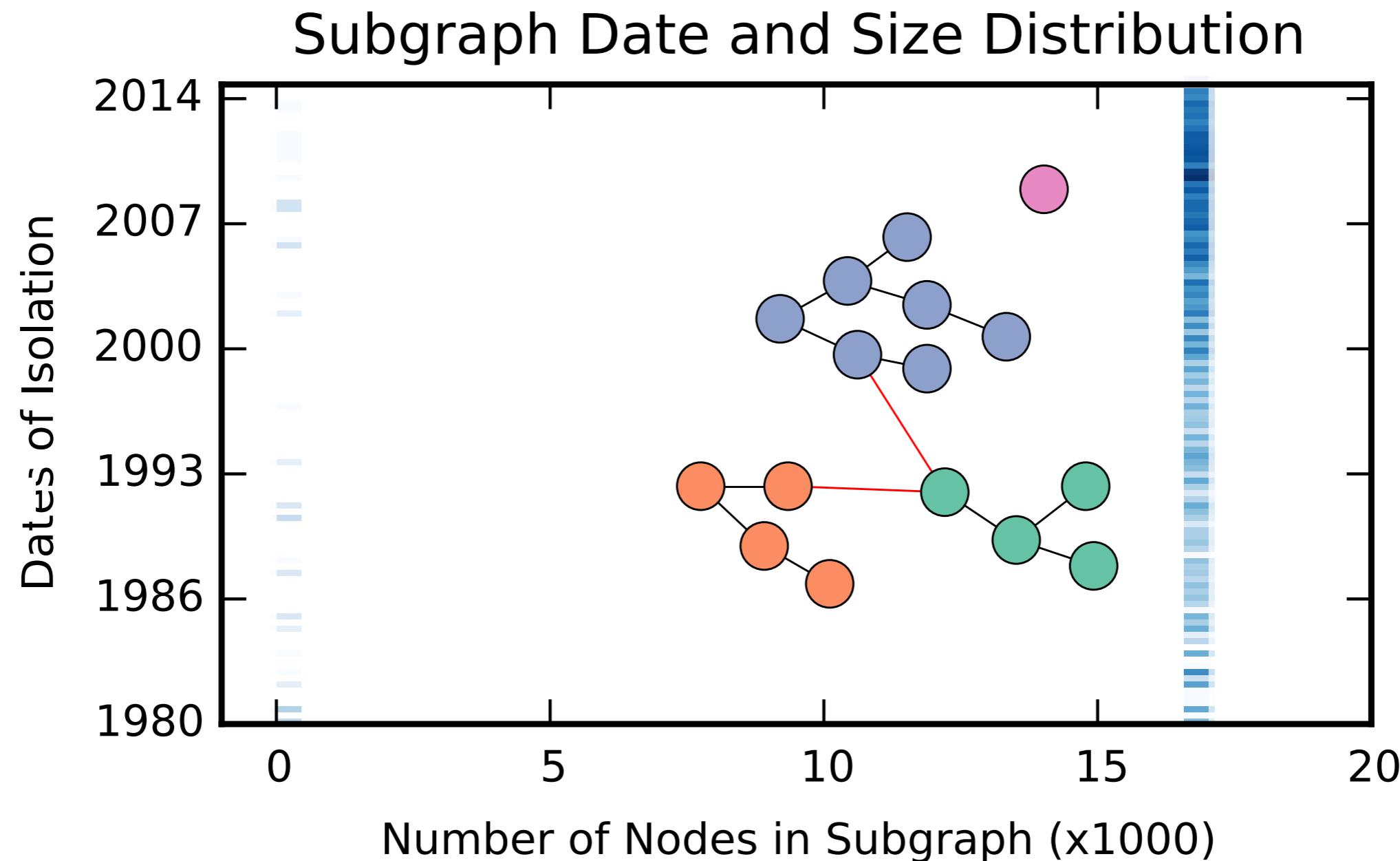
— Whole Genome  
— Reassortment



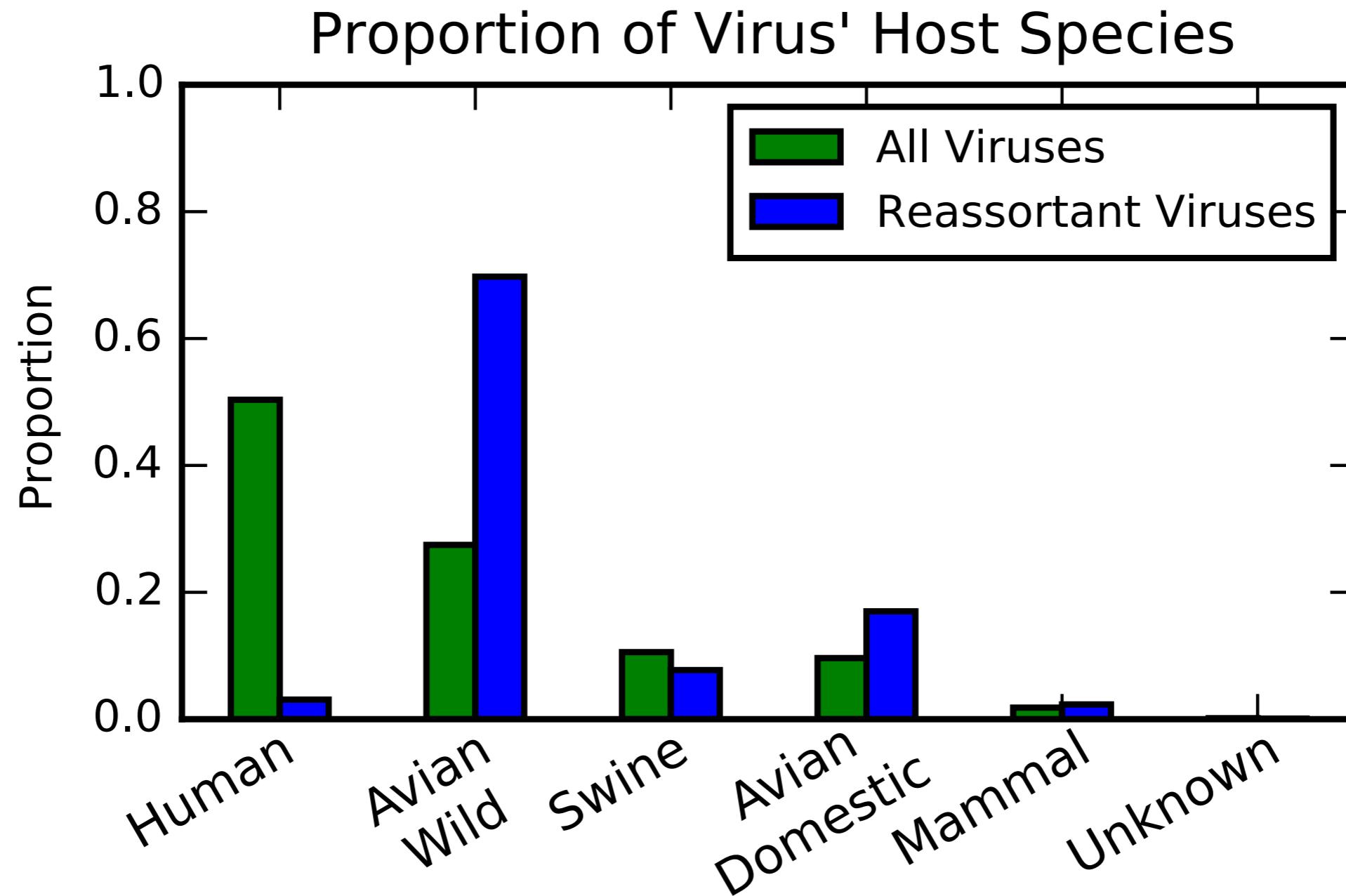
# Reassortment joins influenza isolates in a global network of gene exchange



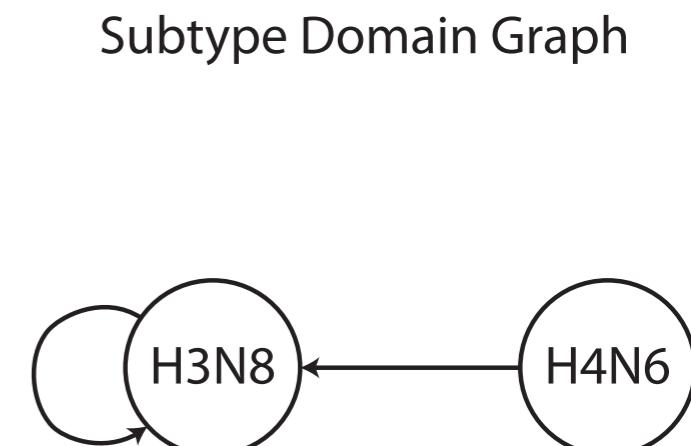
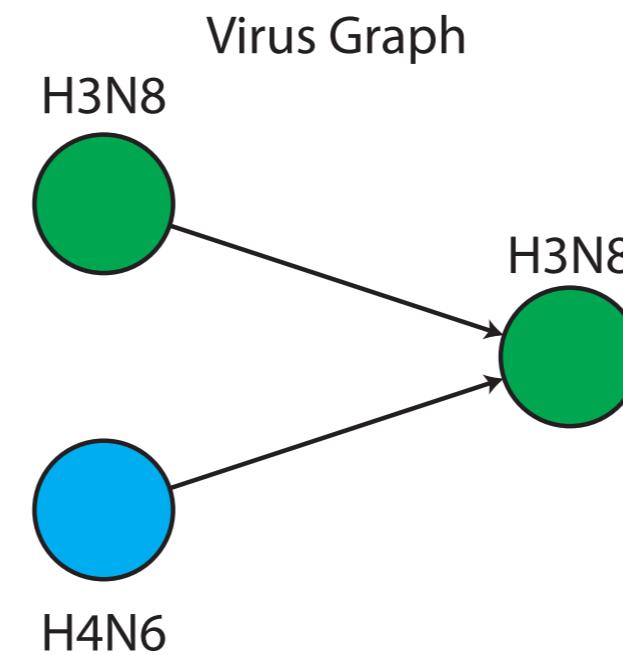
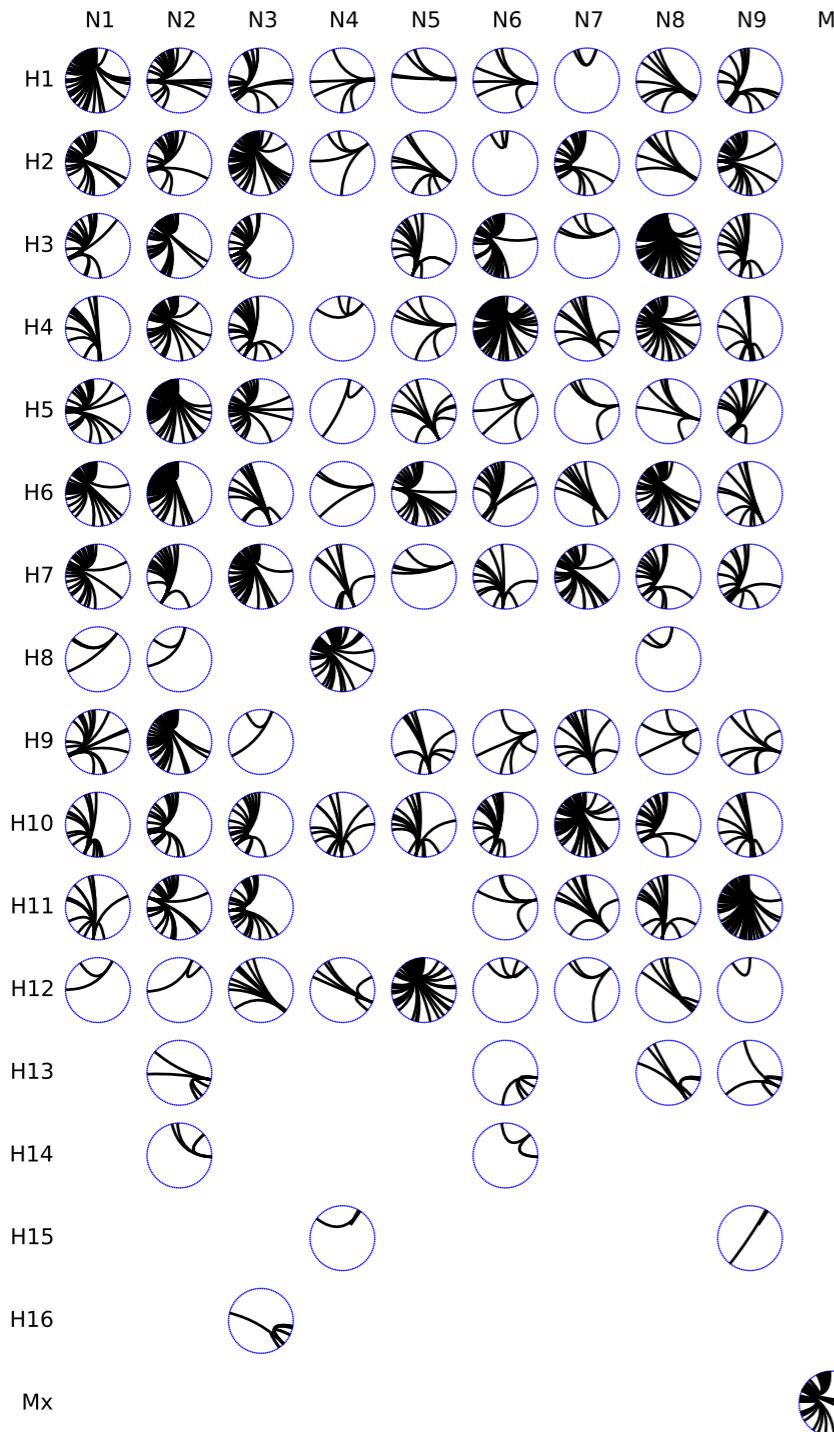
# Reassortment joins influenza isolates in a global network of gene exchange



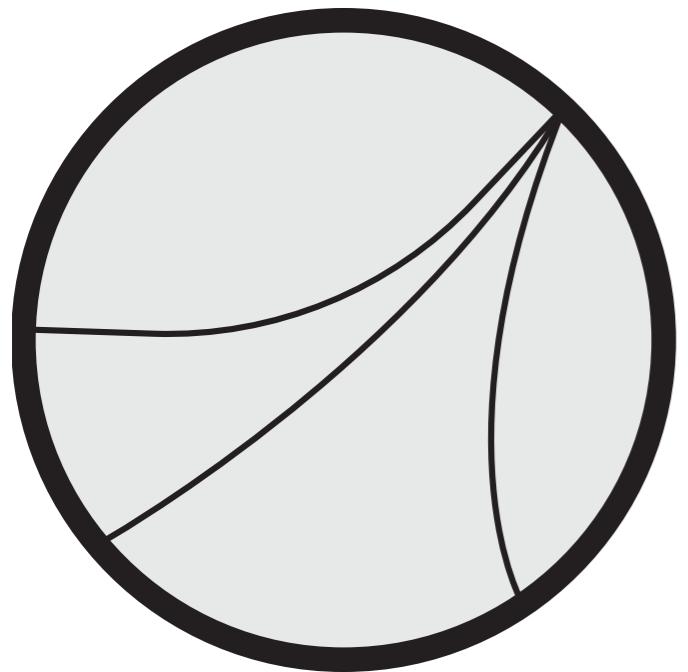
# Reassortment joins influenza isolates in a global network of gene exchange



# Host ecology defines subtype reassortment activity

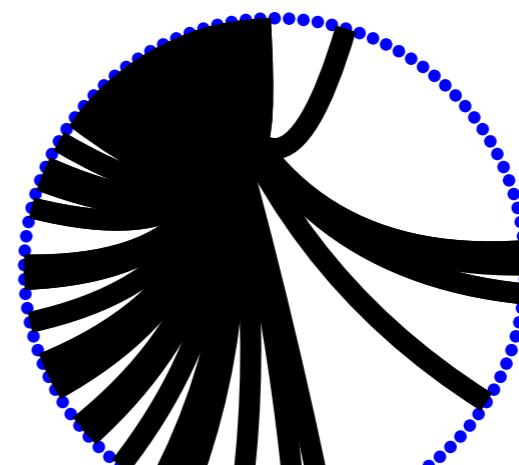


12 o'clock: least connected

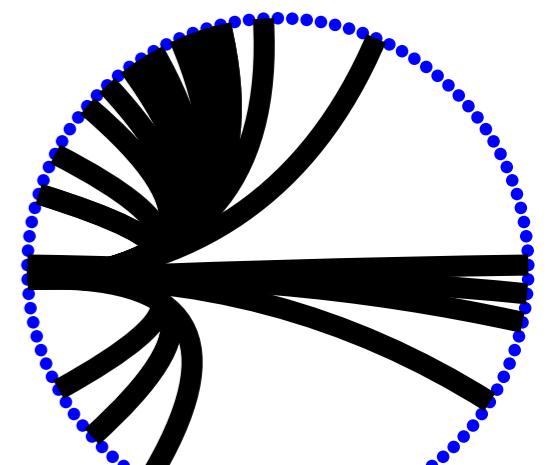


increasing  
subtype  
connectivity

H1

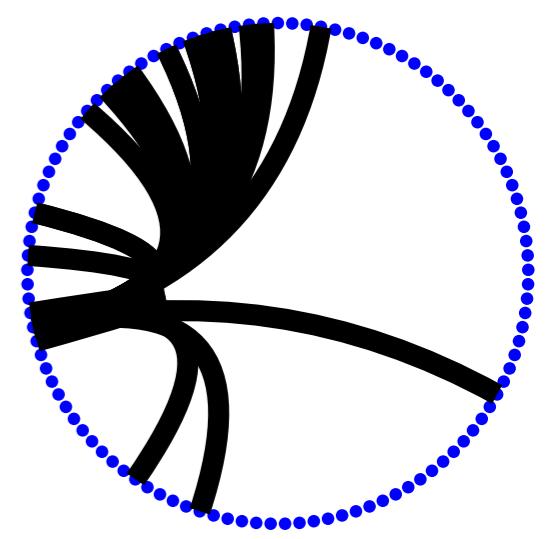
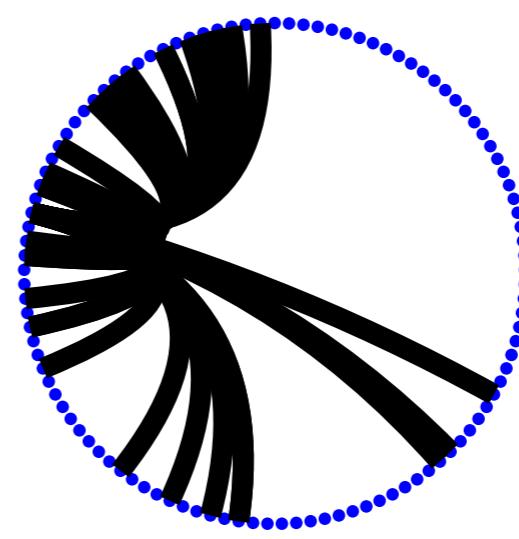


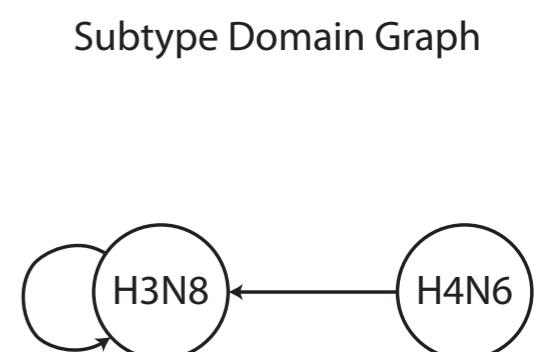
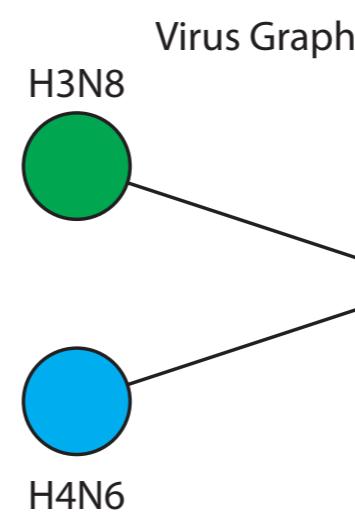
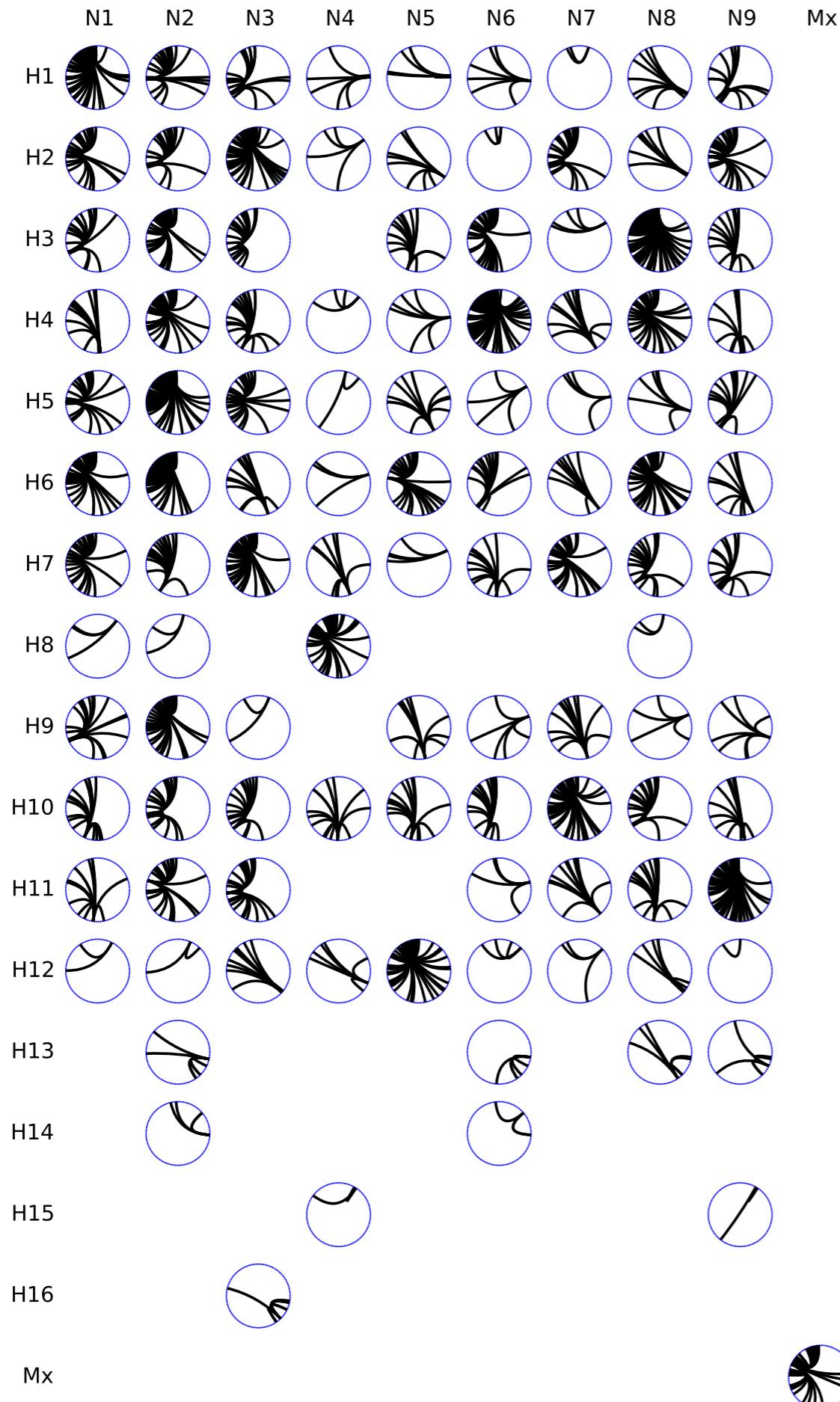
N1



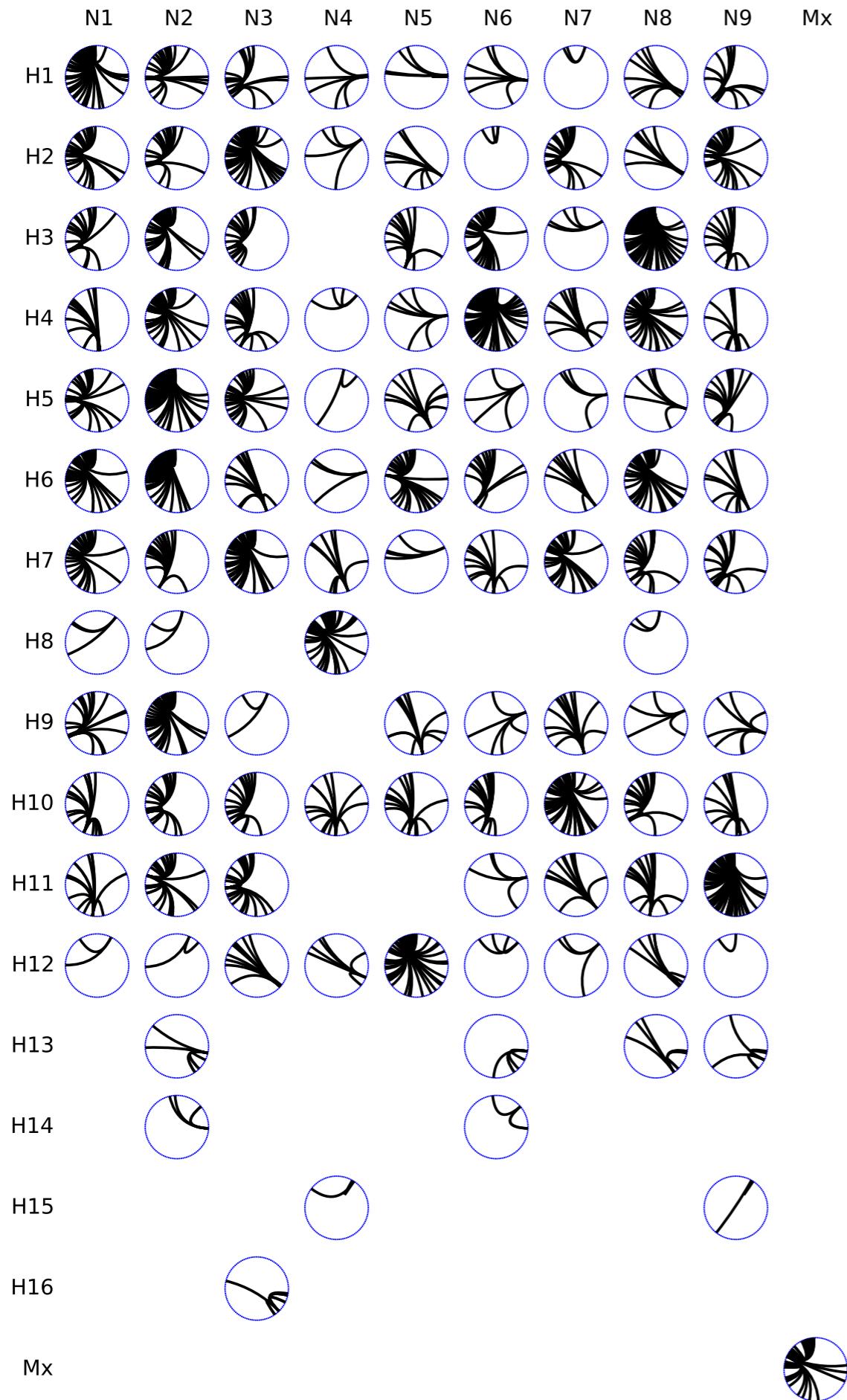
N2

H2





increasing  
subtype  
connectivity



**Reassortment is best explained by host ecological factors.**

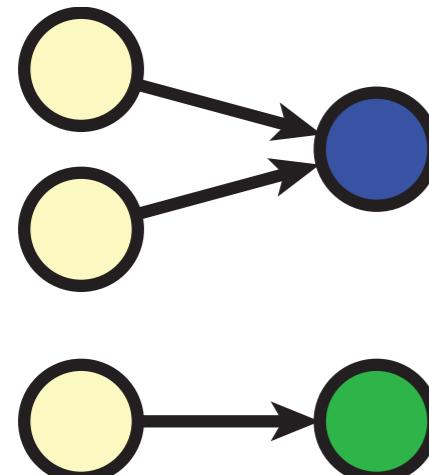
Factor	$r^2$
Sampling	0.17
Host Range	0.81
Geographic Dispersal	0.55

# Reassortment is overrepresented at host group switches

## Host groups

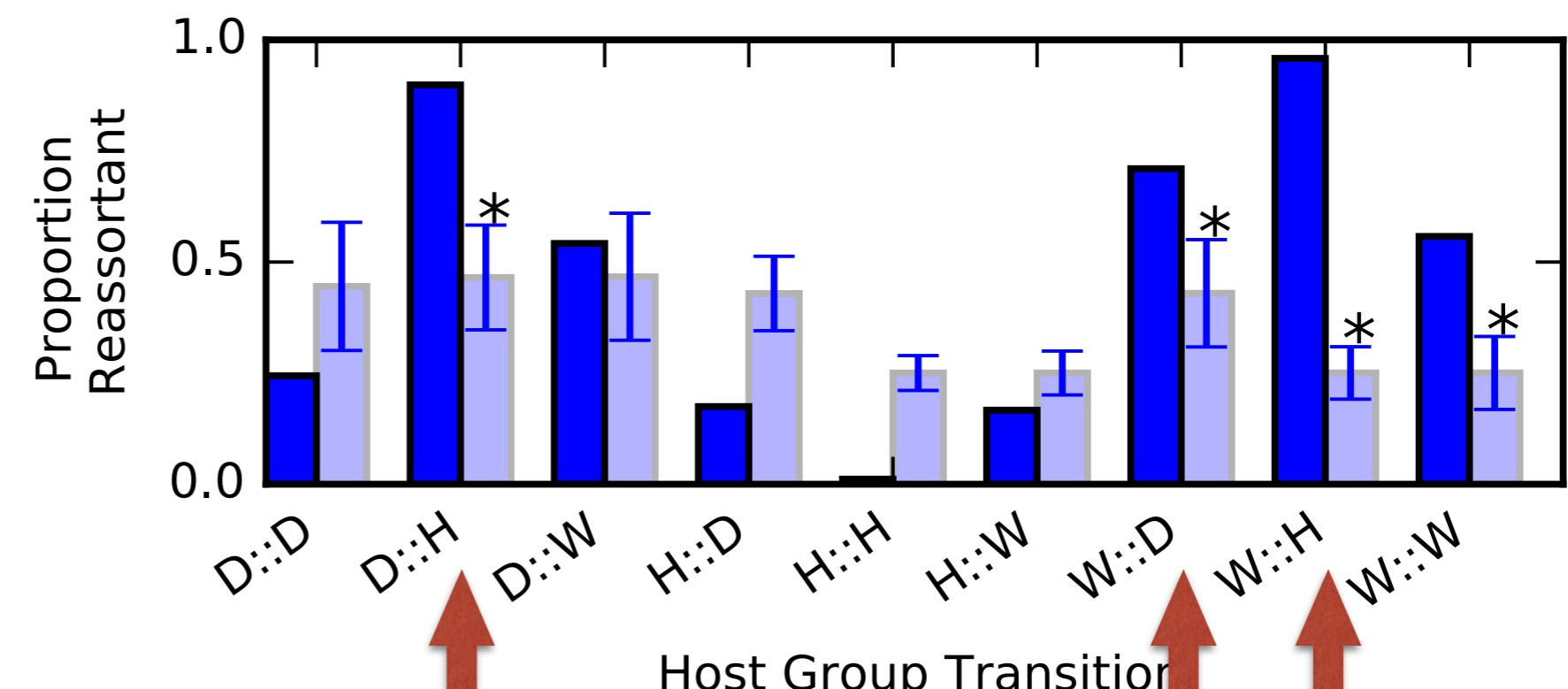
1. Wild
2. Domestic
3. Human

## Network motif



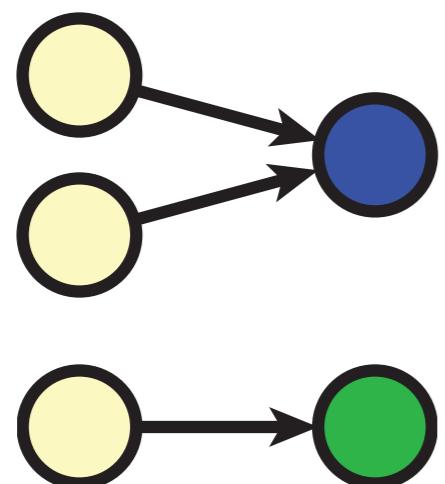
## Over-representation at interfaces

Permutation  
Data

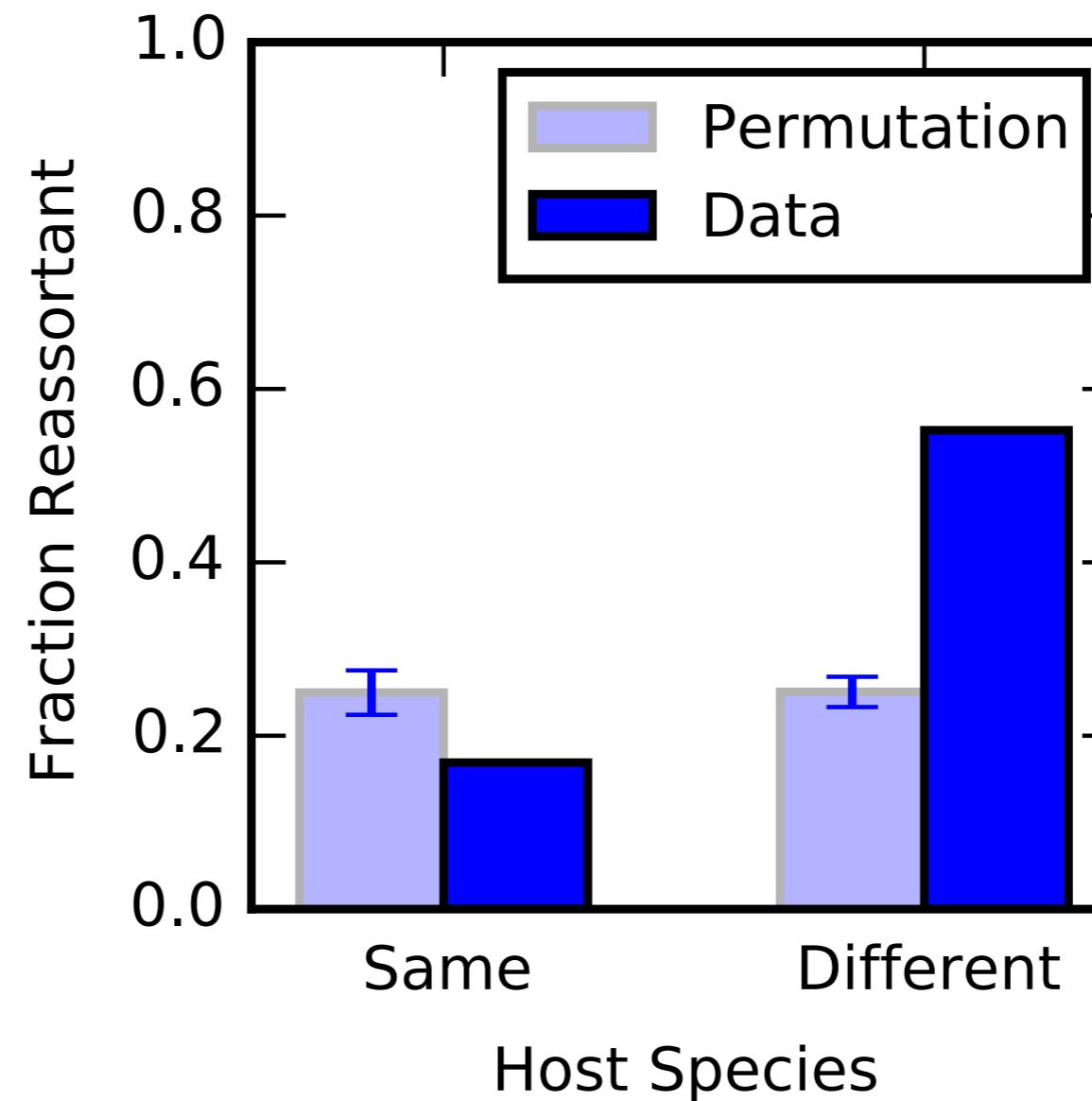


# Reassortment favoured when switching host species

**Network motif**



**Favoured when hosts differ**



# Conclusions

## **Reassortment: important for viral host switching.**

We have mapped reassortment, and quantitatively defined its importance.



## **Reassortment in nature: explainable by ecology**

We are developing predictive probabilistic models.

## **Open Science**

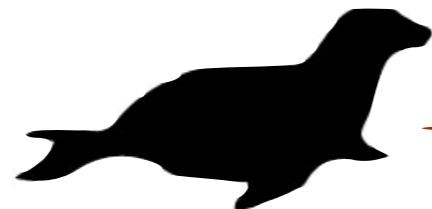


# Acknowledgments

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**RUNSTADLER  
LABORATORY**

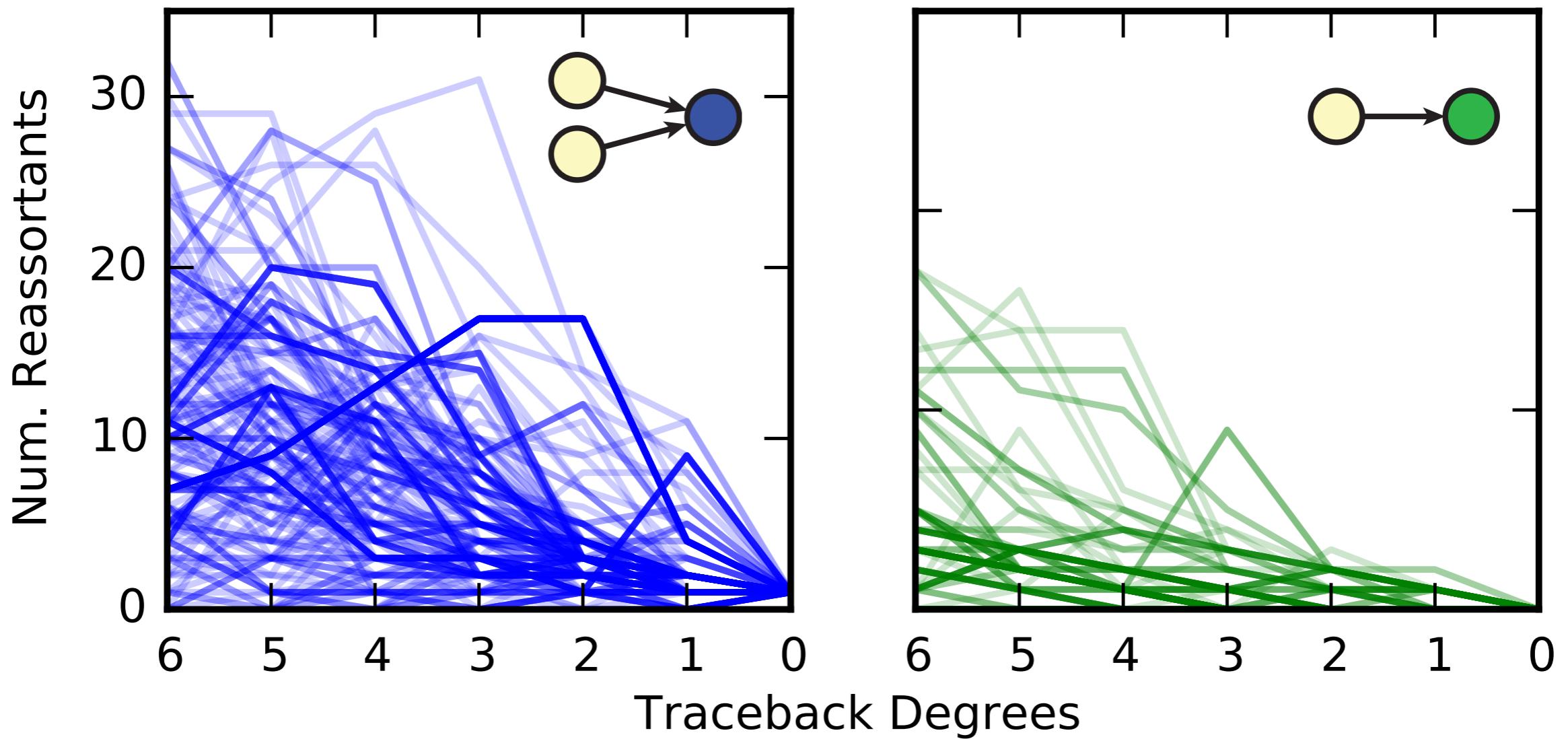


Nichola Hill  
Kyle Yuan  
Justin Zabilansky

Jonathan Runstadler (MIT)  
Mark Bathe (MIT)  
JP Onnela (HSPH)

# Reassortment precedes host group switches

**High representation in lineage**



# Reassortment precedes host group switches

**Most reassortants in lineage trace come from wild birds**

