

Mean gene-wide dN/dS estimates

- Are not the way to go, **except** when you have very small (2-3 sequence) datasets
- For example:
 - The humoral arm of the immune system mounts a potent defense against viral infections
 - Existing successful vaccines are based on raising a neutralizing antibody (nAb) response to the pathogen
 - No simple host genetic basis (epitopes) of the specificity of neutralizing antibody responses is known
 - Need to measure these responses

Neutralization curves from an individual with early HIV infection

- Neutralization can be measured by the serum dilution needed to reduce viral replication by 50% (typically presented as the inverse of the titer)
- Although variable between individuals, the rate of escape from neutralizing antibodies can be very high during acute/early HIV infection
- Sera are effective at neutralizing earlier viruses, but significantly less effective at neutralizing contemporaneous viruses
- The immune system loses the arms race

