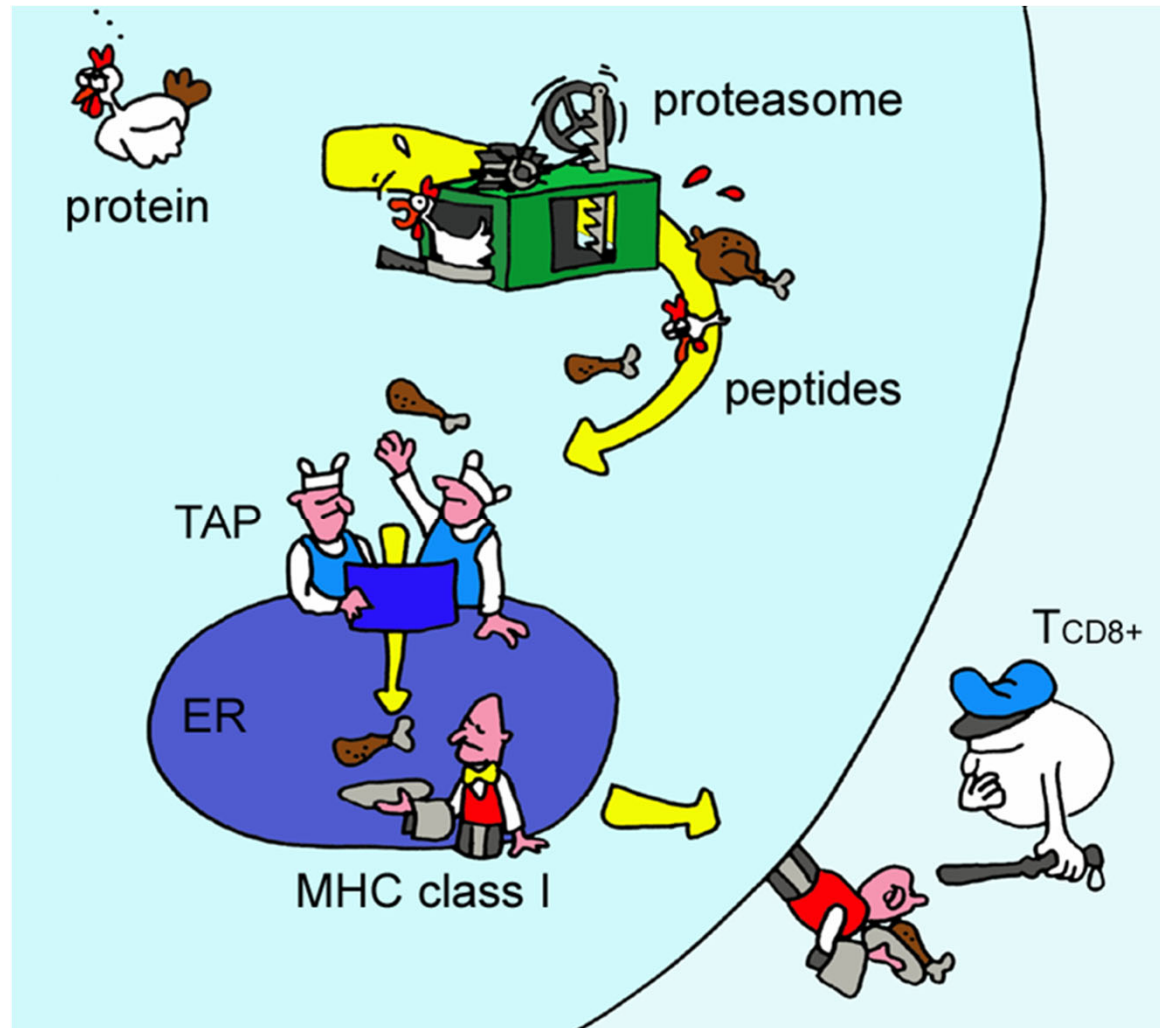


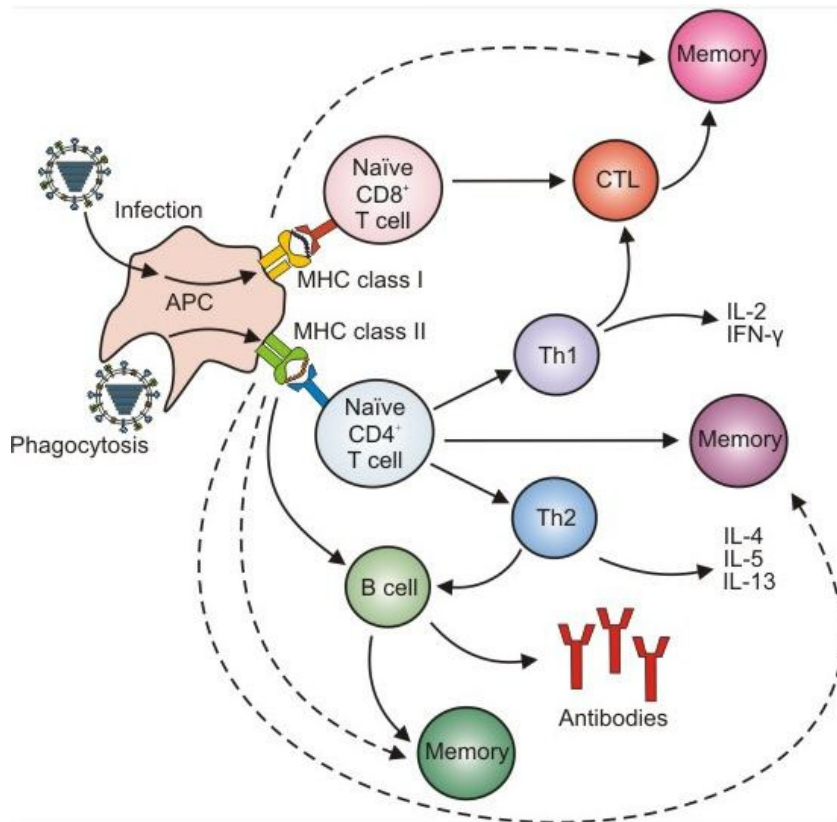


Pathogen recognition of in host cells





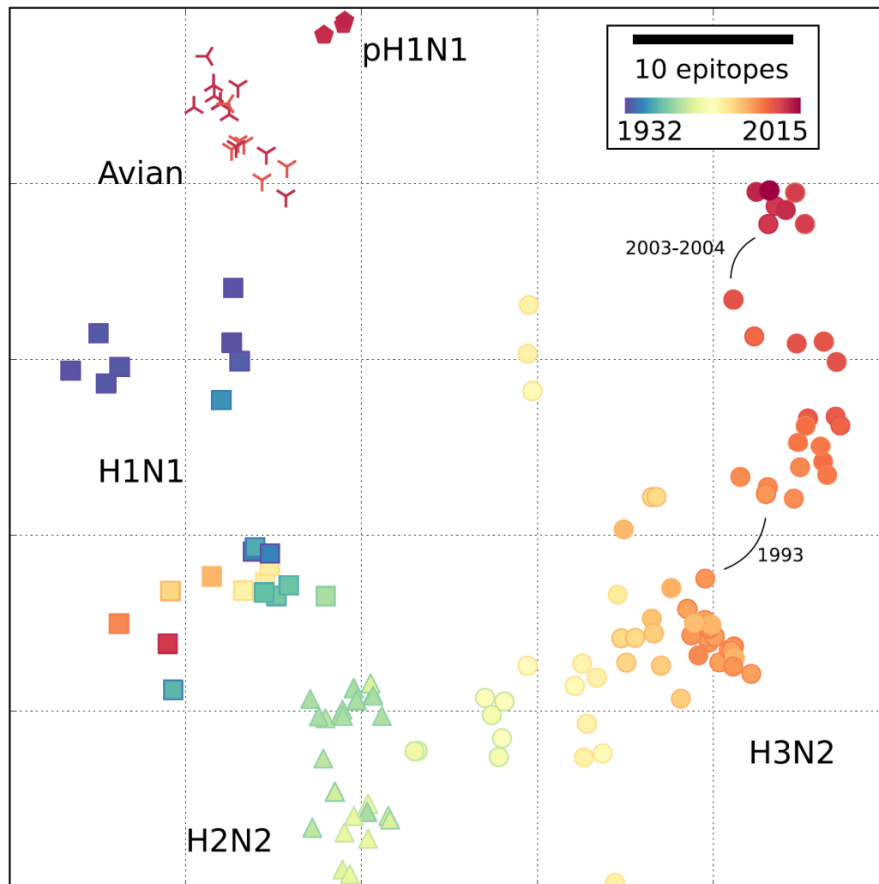
The immune response is multifaceted and complex



- Innate immune responses
- Adaptive immune responses
 - Humoral immunity (antibodies)
 - Extracellular activity (HA and NA)
 - Can give sterilising immunity
 - Antigenic drift and specificity of immune responses lead to immune escape in 2-7 years
 - Cellular immunity (CD4+/CD8+ T cells)
 - Recognise intracellular infection
 - Directed against all pathogen proteins
 - Modulate shedding and disease severity
 - Relatively conserved across viruses
 - High host specificity, determined by HLA
 - Guiding humoral responses



CD8+ T cell antigenic map



- Use multidimensional scaling based on Jaccard index to visualise antigenic evolution of all 142 CD8+ T cell epitopes
- Map explains 93% of the Jaccard index variance
- Overall evolution of CD8+ T cell epitopes is gradual, even across subtypes, with small number of larger shifts
- Avian viruses (H5N1, H7N9, H9N2) are closest to pH1N1 (≥ 62 epitopes overlap) and more distant to recent H3N2 (≤ 53 epitopes overlap)
- Assessment of novel viruses is almost instantaneous (with a sequence at hand)