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The mathematics of drifting influenza.

Influenza epidemics occur almost every winter and most individuals are reinfected every few years. Influenza infection confers long lasting immunity to the infecting strain of influenza but the primary antigens of influenza change so that an individual will be susceptible to the current strain of flu every few years. This slow change of viral antigenic properties is called 'influenza drift.' The mathematical modelling of drifting influenza has aimed at addressing two questions: How does influenza drift affect the epidemiology of influenza and how does influenza drift arise?

While epidemics are naturally described as a dynamical process, immunity is a discrete property of the individual with strong cross-correlations amenable for combinatorial methods. The main mathematical challenge for influenza modelling has been to incorporate the complex immune structure of the host population and the epidemic dynamics in same model. Also the ever-changing antigens implies that the model be cast in a moving antigenic frame.