Multiple-fronts costs of defence: the case of the swarming T-helper cells

Andrea L. Graham
Princeton University

Individual-level heterogeneity is abundantly clear in host-parasite interactions, and all the more so during a global pandemic: hosts exhibit remarkable heterogeneity in the strength, speed and specificity of their immune responses, which in turn generates varied susceptibility to infectious and autoimmune diseases and varied propensity to transmit disease. Why do hosts vary so much? One important category of explanation for host variation arises from cost-benefit analysis of defence. I will illustrate how multiple-fronts costs of defence, for example, can help to explain host heterogeneity in natural populations subject to co-infections. I will focus on a particular mechanism generating multiple-fronts costs in mammals: when T-helper cells polarize into worm-clearing and germ-clearing factions. Subtle differences in initial conditions can be amplified by the collective behavior of T-helper cells to generate radically different system-level responses in different hosts. I will outline how adaptive systems analysis is beginning to shed light on the adaptive value of "agile swarms" of these cells during infections, even if acute worm-germ co-infections may prove costly to hosts.