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Editorial

Infection and Immunity

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Understanding the interactions between hosts and pathogens requires in-depth knowledge of extremely complex biological systems. Pathogen flags (PAMPs) or virulence factors interact with or stimulate the host receivers, which include numerous pattern recognition receptors, in a simplified pathway. In an environment with hundreds of spatiotemporal and epidemiological variables, these interactions either occur or do not. Additionally, the interactions become part of a more dynamic and complex system due to the coevolution of the host and pathogen. Based on our understanding of the conflict or coexistence between the host and pathogens, health or disease status could be changed in a systematic manner. However, it depends on whether we want to alter our focus on deterring infections or favour a homeostatic equilibrium in response to stimuli. What we can learn from the immune organ system is that balance is the secret to life. The sense of interaction could be changed from "fighting" to "fitting" based on the novel insight. Despite the conventional wisdom that infections should be treated with drugs or vaccines, coexistence with less harm or energy use would be ideal and cost-effective. Based on the traits that affect our fitness, natural selection drives the evolution of our pattern of survival and reproduction. Additionally, pathogens do not always evolve to improve or worsen virulence beyond the specifics of the molecular or cellular basis.

The coevolution of the host and pathogen generates a unique "trade of" and/or "balance" with a notable decrease in pathogenicity and host immune responses, each in their own way. It is possible to control the spread of disease or change the environment to a norm, standard, or desired status quo in a number of ways, including management and rearing practices, immunisation, and choice of enhanced disease resistance. While experiments and field trials can involve costly and immoral processes, perfect decision-making requires intuition. Simulations and mathematical modelling have evolved into crucial experimental and computational tools for dynamic and complex frameworks. It is interesting to note that the immune system offers invaluable models for these kinds of strategies because of the disciplines and principles guiding its behaviours and responses. Researchers will be able to the transmission and management of newly or reemerging infectious diseases with the use of mathematical modelling, which also provided us with profound insight into infection and immunity. In veterinary science, mathematical models made notions like "herd immunity" clear for vaccination plans.

However, picking a model for host-pathogen interactions is difficult and requires some thought. The goodness of fit measures how well the host immunity "fits" with the pathogens in its environment and serves as a parameter for model selection. In this situation, population genetics-related dissipation or "fitness flux" affects mathematical models. In light of this, the model should include variables related to immunogenetics and pathogenic coevolution.