Effect of immunological defense against vector on disease transmission in Bird malaria

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Many infectious diseases are caused by parasites and pathogens that are vectored by insects. The evolution of insect-transmitted parasites is shaped by interactions with both vertebrate and insect hosts. Pigeons have many parasites in the wild; however, our study focuses on two of these parasites: hippoboscid fly – the macroparasite and a malaria parasite: *Haemoproteus columbae* – the microparasite and their interactions with the pigeon and the interaction between them. Malaria in birds can be a serious parasitic disease, as it often is in humans. Some birds die from the infection while others spread it. Hippoboscid flies take their blood meals from pigeons, which are often infected with malaria. The fly then acts as a vector, transferring malaria between bird hosts. The malaria parasite must undergo a sexual reproductive stage in the fly and an asexual reproductive stage in the bird to complete its life cycle, thus potentially impacting the fitness of both the bird and the fly. Pigeons make antibodies to flies when exposed to biting supported by the experimental data which shows the change in antibody level, measured as "optical density". The birds with flies in their backpack have significantly greater changes in their fly-specific antibody levels when exposed to flies. As pigeons develop fly antibodies, this has an impact on the transmission of flies and consequently on the disease prevalence. Also the disease prevalence depending on the fly transmission has a feedback on the persistence of fly population.

We are investigating the system from two perspectives through mathematical modelling. From the parasitic fly's point of view we are interested in the effects of malaria on fly fitness. Understanding whether malaria impacts the fitness of its vector, has implications for the transmission dynamics of malaria and possibly other vectored pathogens. From the host's point of view we are interested in how hosts combat parasites immunologically. In this project we have seen host immunological defenses against vector affect vector transmission as well as its colonization with the host which in turn affects the disease prevalence and fly population size. This study has a resemblance with the vector borne diseases of human malaria. This is also relevant to understand the vector dynamics in disease transmission and implementing control strategies through anti-vector vaccines designed to target the vectors in such a way that they protect against vector feeding and so pathogens transmitted by the vector – which is a new approach.