

ORAL PRESENTATION

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# Intra-host dynamics of mixed species malaria parasite infections in mice and mosquitoes

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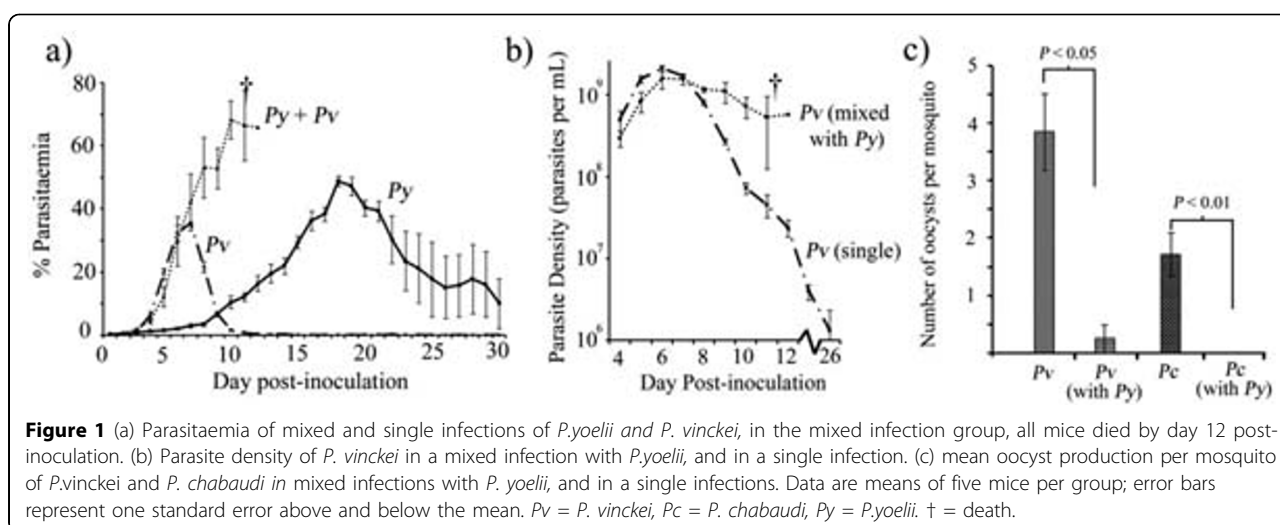
## Background

The distributions of human malaria parasite species overlap in most regions of the world where malaria is present, and co-infections involving two or more malaria parasites are common. Currently, very little is known about the consequences of any interactions that may occur between species during co-infection for disease severity and parasite transmission success. However, current anti-malarial interventions such as vector control and drug interventions and the future application of vaccines will and do have disproportionate effects on some species compared to others; with the ultimate consequence of reducing the number of species in circulation in any one area. We believe that such a situation warrants a clearer understanding of how the interactions

between species affect malaria disease and transmission dynamics.

## Methods

As controlled competition experiments using human malaria parasites are currently practically impossible, we assessed the consequences of mixed-species infections on parasite fitness, disease severity and transmission success using the rodent malaria parasite species *Plasmodium chabaudi* (strains AS and CB), *P. yoelii yoelii* (CU) and *P. vinckei lentum* (DS). We compared the fitness of individual species within co-infections and in single species infections in mice. We also assessed the disease severity of single versus mixed infections in mice by measuring mortality rates, anaemia and weight loss.



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Finally, we compared the transmission success of parasites in single or mixed species infections by quantifying oocyst development in *Anopheles stephensi* mosquitoes.

## Results

We found that co-infections of *P. yoelii* with either *P. vinckei* or *P. chabaudi* led to a dramatic increase in infection virulence, with 100% mortality observed in mixed species infections, compared to no mortality for *P. yoelii* and *P. vinckei* single infections, and 40% mortality for *P. chabaudi* single infections. The increased mortality in the mixed infections was associated with an inability to clear parasitaemia (Figure 1a), with the non-*P. yoelii* parasite species persisting at higher parasite densities than in single infections (Figure 1b). *P. yoelii* growth was suppressed in all mixed infections compared to single infections. Transmissibility of *P. vinckei* and *P. chabaudi* to mosquitoes was also dramatically reduced in the presence of *P. yoelii* in co-infections compared to single infections (Figure 1c).

## Discussion

The increased virulence of co-infections containing *P. yoelii* (reticulocyte restricted) and *P. chabaudi* or *P. vinckei* (predominantly normocyte restricted) may be consequences of parasite cell tropism and/or immune modulation of the host. We explain the reduction in transmission success of species in co-infections in terms of inter-species gamete incompatibility.

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