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GENERAL MODELS OF HOST-PARASITE SYSTEMS. GLOBAL ANALYSIS

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Abstract. We obtain global stability results for within-host models with k age-class of parasitized cells and two strains of parasites. The stability is determined by the value of the basic reproduction ratio $\mathcal{R}_0$. A competitive exclusion principle holds. This means that if $\mathcal{R}_0 > 1$ generically an unique equilibrium, corresponding to the extinction of one strain and the survival of the other strain, is globally asymptotically stable on the positive orthant.

1. **Introduction.** Intra-host models of malaria describe the dynamics of the blood-stage of the parasite and their interaction with host-cells, in particular red blood cells (RBC) and immune effectors. During the past decade there has been considerable work on the mathematical modeling of *Plasmodium falciparum* infection [1, 12, 15, 16, 18, 17, 19, 22, 23, 32, 34, 35, 36, 41]. A review has been done by Molineaux and Dietz in [37]. Such models are used for different purposes: to explain observations, predict impact of intervention, e.g. in the use of antimalarial drugs, and to estimate hidden states or parameters.

We give a brief review of the features of malaria. Malaria in a human begins with an inoculum of *Plasmodium* parasites (sporozoites) from a female *Anopheles* mosquito. The sporozoites enter the liver within minutes. After a period of asexual reproduction in the liver the parasites (merozoites) are released in the bloodstream where the asexual erythrocyte cycle begins. The merozoites enter red blood cells (RBC), grow and reproduce over a period of approximatively 48 hours after which the erythrocyte ruptures releasing daughter parasites that quickly invade a fresh erythrocyte to renew the cycle. This blood cycle can be repeated many times, in the course of which some of the merozoites instead develop in the sexual form of the parasites : gametocytes. Gametocytes are benign for the host and are waiting for the mosquitoes.

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