Assessing the advantage of morphological changes in *Candida albicans*: a game theoretical study.

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Abstract

A range of attributes determines the virulence of human pathogens. During interactions with their hosts, pathogenic microbes often undergo transitions between distinct stages, and the ability to switch between these can be directly related to the disease process. Understanding the mechanisms and dynamics of these transitions is a key factor in understanding and combating infectious diseases. The human fungal pathogen Candida albicans exhibits different morphotypes at different stages during the course of infection (candidiasis). For example, hyphae are considered to be the invasive form, which causes tissue damage, while yeast cells are predominant in the commensal stage. Here, we described interactions of C. albicans with its human host in a game theoretic model. In the game, players are fungal cells. Each fungal cell can adopt one of the two strategies: to exist as a yeast or hyphal cell. We characterized the ranges of model parameters in which the coexistence of both yeast and hyphal forms is plausible. Stability analysis of the system showed that, in theory, a reduced ability of the host to specifically recognize yeast and hyphal cells can result in bi-stability of the microbial populations' profile. Inspired by the model analysis we reasoned that the types of microbial interactions can change during invasive

candidiasis. We found that positive cooperation among fungal cells occurs in mild infections and an enhanced tendency to invade the host is associated with negative cooperation. The model can easily be extended to multi-player systems with direct application to identifying individuals that enhance either positive or negative cooperation. Results of the modeling approach have potential application in developing treatment strategies.

Involved units

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