

Abstract Submitted
for the MAR12 Meeting of
The American Physical Society

Evolution of cooperation in microbial biofilms - A stochastic model for the growth and survival of bacterial mats JOHANNES KNEBEL, JONAS CREMER, ANNA MELBINGER, ERWIN FREY, Ludwig-Maximilians University of Munich — Cooperative behavior is essential for microbial biofilms. The structure and composition of a biofilm change over time and thereby influence the evolution of cooperation within the system. In turn, the level of cooperation affects the growth dynamics of the biofilm. Here, we investigate this coupling for an experimentally well-defined situation in which mutants of the *Pseudomonas fluorescens* strain form a mat at the liquid-air interface by the production of an extra-cellular matrix [1]. We model the occurrence of cooperation in this bacterial population by taking into account the formation of the mat. The presence of cooperators enhances the growth of the mat, but at the same time cheaters can infiltrate the population and put the viability of the mat at risk. We find that the survival time of the mat crucially depends on its initial dynamics which is subject to demographic fluctuations [2]. More generally, our work provides conceptual insights into the requirements and mechanisms for the evolution of cooperation.

[1] P. Rainey et al., Nature 425, 72 (2003).

[2] A. Melbinger et al., PRL 105, 178101 (2010).

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Date submitted: 11 Nov 2011

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