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Tuesday, November 26, 2013

16:00~17:00 C1F Auditorium

## Social evolution shapes the diversification of bacterial intercellular signaling

### Summary

Microbial 'quorum sensing' (QS) systems, where microbes produce and respond to a signaling molecule, enable cells to sense their local density and coordinate a cooperative response to their environment. QS-dependent cooperation is prone to exploitation by a signal reception mutant that avoids the costs of Quorum-response but rip the cooperative benefits. Cheater null alleles are rare in wild isolates but in contrast, many QS systems show intraspecific allelic divergence of receptor-signal locus in which all alleles are functional but a signaling molecule from one allelic type (known as pherotype) activates its cognate receptor but fails to activate those of other receptor variants in the same species. The phylogeny of the QS locus often deviates from the house-keeping phylogeny, indicating some level of selection for horizontal gene transfer (HGT). It is unclear what evolutionary mechanisms explain the lack of null alleles and the existence and phylogenetic patterns of multiple different pherotypes and how does this evolutionary pattern relate to the cooperative behavior of the cells. In this talk I would present a combination of bioinformatical analysis, theoretical modeling and experiments in the model bacteria *B. subtilis* that explain this evolutionary pattern. We demonstrate that a *B. subtilis* reception null mutant is a cheater of the wild-type – in well-mixed environments, it invades into the wild-type population and lead to a general reduction of fitness. The wild-type resist the invasion if the population is spatially structured. When strains from different pherotypes compete, we find that the minority pherotype always invade the majority pherotype and that this invasion will occur also in highly structured environment. Our results can be explained by a model that requires a QS-dependent cooperative behavior. We therefore conclude that QS is a cooperative trait but that the strong structure of the environment prevents the evolution of cheaters, while allowing the evolution of new pherotypes and their rapid spread through horizontal gene transfer.

### Host:

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