Cologne Evolution Colloquium

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Kin discrimination alters bacterial exploitation and horizontal gene transfer

Bacteria live in diverse communities where they engage in cooperative and antagonistic cell-cell interactions, affecting their composition and function. However, we have a limited understanding of how relatedness of bacteria affects their behaviours and the outcomes of their interactions. We use isolates of *Bacillus subtilis* to address these questions during cooperative swarming or in biofilms. We find that phylogenetic relatedness (kinship) between *B. subtilis* isolates affects their swarm compatibility and strain segregation in biofilms by excluding non-kin cells from common groups. In contrast, highly related cells merge their swarms and mix in biofilms. Hence, this differential behaviour is an example of kin discrimination, which Hamilton predicted could limit expansion of exploiters and stabilize cooperative behaviours. We tested this prediction by mixing mutants (exploiters) that do not produce public goods (e.g. surfactants) with their kin or non-kin cooperative producers. Indeed, mutants were helped only by their kin, who accepted them within their swarms but exploiters were not helped by rather excluded by nonkin. Kin discrimination also promoted horizontal gene transfer at the swarm encounter area. Specifically, non-kin encounters induced a stress response in the attacked cells positioned at the swarm edge, which generated an unknown activation signal of the competence genes and the DNA uptake in the attacker. Under specific selection, this interaction provided the attacker with an ecological advantage. Hence, kin discrimination can be a powerful force shaping war, cooperation and evolution of the species through intricate cell-cell dialogues.

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