**Title:**
Fungal hyphal networks regulate interspecies competition during surface-associated microbial growth

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**Abstract (300 words maximum): :**
Fungal hyphae develop fractal-like hyphal networks that efficiently spread in heterogeneous habitats, penetrate air-water interfaces and cross over air-filled pores, thereby serving as pathways (also called "fungal highways") for bacteria to efficiently disperse, forage and colonize new habitats. Recent research demonstrated that fungal hyphae-mediated dispersal can increase bacterial spatial intermixing during surface-associated growth. Therefore, we hypothesized that fungal hyphal networks can also influence interspecies competition induced by contact-dependent weapons (type VI secretion system, T6SS) during surface-associated growth.

Here, we test our hypothesis by experimentally quantifying how a fungal hyphal network regulates contact-dependent killing during surface-associated growth. We demonstrate that a fungal network enhances the spatial intermixing and extent of range expansion of the bacterial strains, thereby enhancing the ability of V. cholerae (attacking cell) to kill and out-compete E. coli (target cell). Using T6SS knockout mutant strains, we further found that contact-dependent killing is essential to explain the improved competitive advantage of V. cholerae. Furthermore, we show that the underlying cause is that the water films surrounding fungal hyphae facilitate flagellar motility, subsequently increasing spatial intermixing and enhancing killing.

In conclusion, our study reveals that fungal hyphal networks promote contact-dependent killing and regulate competitive outcomes, specifically through enhancing spatial intermixing during surface-associated growth. Our study underscores the importance of physical structures like fungal hyphae in shaping microbial community dynamics and may provide insights into controlling microbial interaction in ecological and medical contexts.