

Title:

Trading with a zombie: Non-growing bacteria can metabolically interact with and support the growth of others

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Abstract (300 words maximum): :

Microbial communities play a crucial role in the functioning of all ecosystems on Earth. Members of these communities often rely on the exchange of metabolites between members to acquire essential nutrients. Although advantageous, these cross-feeding interactions introduce a dependency of one bacterium's survival on its interacting partners. Environmental and nutritional fluctuations, frequent in natural ecosystems, can cause the arrest of growth of a cross-feeding partner, thereby compromising the interaction. It remains unclear what role growth-arrested microbes could play in the interaction network of a community and its robustness.

To investigate these questions, we have established a community consisting of two members of the gut microbiota: *Escherichia coli* and the probiotic lactic acid bacterium *Lactobacillus plantarum*. Using live-cell imaging of co-cultures in a microfluidic chip, we switch from a rich-medium to a minimal medium, where *L. plantarum* and *E. coli* need to cross-feed to grow. When switching to the minimal medium, we found that *L. plantarum* stops growing but survives and supports the growth of *E. coli*. By looking at single-cell growth rates, we found that this effect is only possible at short distances between the two partners. This result suggests that in fluctuating environments, non-growing bacteria could still metabolically interact with others, increasing the functional robustness of the community. Bacteria in a non-growing but metabolically active state could therefore play an unrecognised role in the organisation and functions of microbial communities.