A Modular Co-Culture Device for *In Situ* Microbial Ecology Studies

Carteles / Pósters

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Microbial interactions within a community, as well as between the community and its environment, play a central role in shaping microbial diversity, abundance, and functional evolution. To better investigate intra-community interactions, we employ co-culture chambers that confine individual species on opposite sides of a permeable vertical membrane, enabling controlled, bidirectional exchange of diffusible molecules and facilitating extracellular metabolite sharing. Likewise, to study community-environment interactions, we integrate a horizontal membrane—drawing inspiration from isolation chip designs—which allows the inflow of substrate nutrients and metabolites from the surrounding microbial community. This dual-membrane system provides a more ecologically relevant framework for studying microbial interactions, as the device can be deployed in natural settings, supporting in situ research on the dynamic and heterogeneous aspects of microbial ecological niches.

Here, we present a low-cost, modular co-culture device that enables standardized optical density measurements across different community compositions and spatial arrangements. We demonstrate its application in a seven-species rhizosphere isolate

community and evaluate its versatility across in vitro, in vivo, and in situ experimental setups. By adapting this system to diverse contexts—ranging from biodiversity monitoring to the cultivation of microbial dark matter—we highlight its potential as a scalable tool, complementing shotgun metagenomics approaches, for investigating microbial interactions in controlled laboratory conditions, mesocosms, and natural environments.

Palabras Clave

(1) co-culture device, (2) microbial ecology, (3) microbial communities, (4) rhizosphere, (5) synthetic microbial consortia, (6) bio-dyi, (7) low-cost.

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