

Artificial microbial arenas: Materials for observing and manipulating microbial consortia.

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Abstract

From the smallest ecological niche to global scale, communities of microbial life present a major factor in system regulation and stability. As long as laboratory studies remain restricted to single or few species assemblies, however, very little is known about the interaction patterns and exogenous factors controlling the dynamics of natural microbial communities. In combination with microfluidic technologies, progress in the manufacture of functional and stimuli-responsive materials makes artificial microbial arenas accessible. As habitats for natural or multispecies synthetic consortia, they are expected to not only enable detailed investigations, but also the training and the directed evolution of microbial communities in states of balance and disturbance, or under the effects of modulated stimuli and spontaneous response triggers. Here, a perspective on how materials research will play an essential role in generating answers to the most pertinent

questions of microbial engineering is presented, and the concept of adaptive microbial arenas and possibilities for their construction from particulate microniches to 3D habitats is introduced. Materials as active and tunable components at the interface of living and nonliving matter offer exciting opportunities in this field. Beyond forming the physical horizon for microbial cultivates, they will enable dedicated intervention, training, and observation of microbial consortia.

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