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Planet Earth-like patterns in three-dimensional multi-species bacterial colonies

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Bacteria typically grow in communities and this provides them substantial advantages compared to solitary cells. These communities are often comprised of multiple bacterial species leading to the emergence of complex spatial patterns. The emergence of these complex spatial patterns can have a profound effect on bacterial function and survival within the communities. Most experimental studies investigating the mechanism behind this pattern formation have focused in two-dimensional systems. Here we propose a novel approach to study three-dimensional multi-species bacterial colonies. This three-dimensional setting replicates better some environmental bacterial habitats such as soil and intestines. Our results indicate that in three-dimensional multi-species colonies just the cells from the outer part of the colony are able to grow while the center of the colony remains static. We anticipate our protocol to be a starting point for further studies. For example, the protocol could be used to bring some light to many different biological and physical questions which are still unanswered such as the mechanism behind horizontal gene transfer and the social interactions arising within multi-species three-dimensional bacterial colonies. Furthermore, understanding how bacteria thrive in competitive habitats and their cooperative strategies for surviving extreme stress can be instructive, for instance, to inspire new investigations for developing a more rational approach for battling pathogenic bacteria resistant to antibiotics.

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Biophysics

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