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The 3-D spatial structure of multicellular aggregates can give them a competition-dependent growth advantage in early biofilm development VERNITA GORDON, U. Texas, Austin, KASPER KRAGH, U. Copenhagen, JAIME HUTCHISON, U. Texas, Austin, GAVIN MELAUGH, U. Edinburgh, CHRIS RODESNEY, U. Texas, Austin, ALED ROBERTS, U. Nottingham, YASUHIKO IRIE, U. Bath, PETER JENSEN, U. Copenhagen, STEPHEN DIGGLE, U. Nottingham, ROSALIND ALLEN, U. Edinburgh, THOMAS BJARNSHOLT, U. Copenhagen — Biofilms are structured communities of sessile microbes. Traditional models of biofilm development begin with single bacteria seeding a surface. However, biofilms can also be seeded by multicellular aggregates. How the three-dimensional structure of aggregates impacts the initiation and development of biofilms is not known. Here we use a combination of experiments and simulations to determine the impact of the seeding structure. We find that whether aggregates or single cells grow better depends on the density of single cells initially seeded. The density of single cells, which we take as our measure of the level of competition, impacts per-cell access to growth resource. The overall biomass accumulation arising from an aggregate is a combination of slow growth in the resource-limited interior, and faster growth on the sides and top. When competition is low, aggregates are disadvantaged, compared with single cells. However, when competition is high, aggregates are fitter than single cells, because the cells at the top of the aggregates have better access to growth resources than do high-density single cells on the surface.

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