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Biofilm streamers cause rapid clogging of flow systems YI SHEN, KNUT DRESCHER, NED WINGREEN, BONNIE BASSLER, HOWARD STONE, Princeton Universtiy — Biofilms are antibiotic-resistant, sessile bacterial communities that are found on most surfaces on Earth. In addition to constituting the most abundant form of bacterial life, biofilms also cause chronic and medical device-associated infections. Despite their importance, basic information about how biofilms behave in common ecological environments is lacking. Here we demonstrate that flow through soil-like porous materials, industrial filters, and medical stents dramatically modifies the morphology of *Pseudomonas aeruginosa* biofilms to form streamers which over time bridge the space between obstacles and corners in non-uniform environments. Using a microfluidic model system we find that, contrary to the accepted paradigm, the accumulation of surface-attached bacterial biofilm has little effect on flow resistance whereas the formation of biofilm streamers causes sudden and rapid clogging. The time at which clogging happens depends on bacterial growth, while the duration of the clogging transition is driven by flow-mediated transport of bacteria to the clogging site. Flow-induced shedding of extracellular matrix from the resident biofilm generates a sieve-like network that catches bacteria flowing by, which add to the network of extracellular matrix, to cause exponentially rapid clogging. We expect these biofilm streamers to be ubiquitous in nature, and to have profound effects on flow through porous materials in environmental, industrial, and medical environments.

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