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Quasi-chemostat behavior in the leading edge of B. subtilis biofilms SIDDARTH SRINIVASAN, LAKSHMINARAYANAN MAHADEVAN, SHMUEL RUBINSTEIN, Harvard University — *Bacillus subtilis* is a gram positive bacterium that is a model system commonly used to study biofilm formation. By performing wide-field time-lapse microscopy on a fluorescently labeled *B. subtilis* strain, we observe a well defined steady boundary layer at the edge of a biofilm growing on an nutrient infused agar gel substrate, within which the outward radial expansion growth predominantly occurs. Using distinct fluorescent protein markers as proxies of gene expression, we quantitatively measure how the width, velocity and ratio of motile cell to matrix cell phenotypes within this boundary layer responds to changes in environmental conditions (such as substrate agar percentage & temperature). We further propose that the steady state at the leading edge can be interpreted as a quasi-chemostat which may enable well controlled response experiments on a colony scale. Finally, we show that for low agar concentration (0.5 wt%), the cells exhibit swarming behavior, whose dynamics and swimming velocities are characterized using differential dynamic microscopy. We show the swarming state is associated with an unstable front which gives rise to fingering and branching growth patterns, illustrating the varied morphological response of the biofilm to environmental conditions

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