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Flow-driven waves and sink-driven oscillations during aggregation of Dictyostelium discoideum[1] AZAM GHOLAMI, VLADIMIR ZYKOV, Max-Planck Institute for Dynamics and Self-Organization, Goettingen, Germany, OLIVER STEINBOCK, Department of Chemistry and Biochemistry, Florida State University, Tallahassee, FL, EBERHARD BODENSCHATZ, Max-Planck Institute for Dynamics and Self-Organization, Goettingen, Germany — The slime mold Dictyostelium discoideum (D.d) is a well-known model system for the study of biological pattern formation. Under starvation, D.d. cells aggregate chemotactically towards cAMP signals emitted periodically from an aggregation center. In the natural environment, D.d cells may experience fluid flows that can profoundly change the underlying wave generation process. We investigate spatial-temporal dynamics of a uniformly distributed population of D.d. cells in a flow-through narrow microfluidic channel with a cell-free inlet area. We show that flow can significantly influence the dynamics of the system and lead to a flow- driven instability that initiate downstream traveling cAMP waves. We also show that cell-free boundary regions have a significant effect on the observed patterns and can lead to a new kind of instability. Since there are no cells in the inlet to produce cAMP, the points in the vicinity of the inlet lose cAMP due to advection or diffusion and gain only a little from the upstream of the channel (inlet). In other words, there is a large negative flux of cAMP in the neighborhood close to the inlet, which can be considered as a sink. This negative flux close to the inlet drives a new kind of instability called sink-driven oscillations.

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