

Quantitative studies of bacteria in microfluidic devices

Mark Polinkovsky¹, Edgar Gutierrez¹, Micha Adler¹, HoJung Cho², Andre Levchenko², and Alex Groisman¹

We present microfluidic devices for various quantitative experiments on bacterial cells with single-cell resolution in controlled micro-environments. Bacterial cells are grown in micro-chambers in chemostatic conditions with a possibility to rapidly change the composition of the growth medium.¹ The colonies reach very high densities without major reduction of the growth rate and eventually fill the entire space of the micro-chambers.¹ The escape of cells from crowded micro-chambers leads to self-organization and ordering of cell orientation in the colonies.² The microfluidic technology is also used to set and rapidly change the level of oxygen in the culture chambers.³ In this fashion, microaerobic conditions are created and the level of oxygen is controlled with a higher accuracy than in macroscopic cultures.³ Finally, we will discuss experiments on oxygen-taxis of various microorganisms in specially-made microfluidic devices.

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- [2] Cho, H. J. *et al.* Self-organization in high-density bacterial colonies: Efficient crowd control. *Plos Biology* 5 (11), 2614-2623 (2007).
- [3] Polinkovsky, M., Gutierrez, E., Levchenko, A., & Groisman, A. Fine temporal control of the medium gas content and acidity and on-chip generation of series of oxygen concentrations for cell cultures. *Lab On A Chip* 9 (8), 1073-1084 (2009).

¹Department of Physics, University of California, San Diego, 9500 Gilman Dr., MC 0374, La Jolla, CA 92093. E-mail: agroisman@ucsd.edu

² Department of Biomedical Engineering, Johns Hopkins University, Baltimore, MD 21218 USA