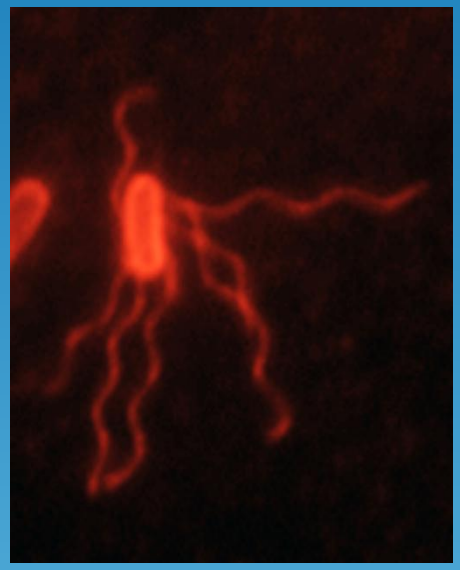
Cooperation and the Evolution of Multicellularity

Division of labor in a Bacterial Swarm

Liyan Ping and Howard C. Berg

The Rowland Institute at Harvard

Introduction



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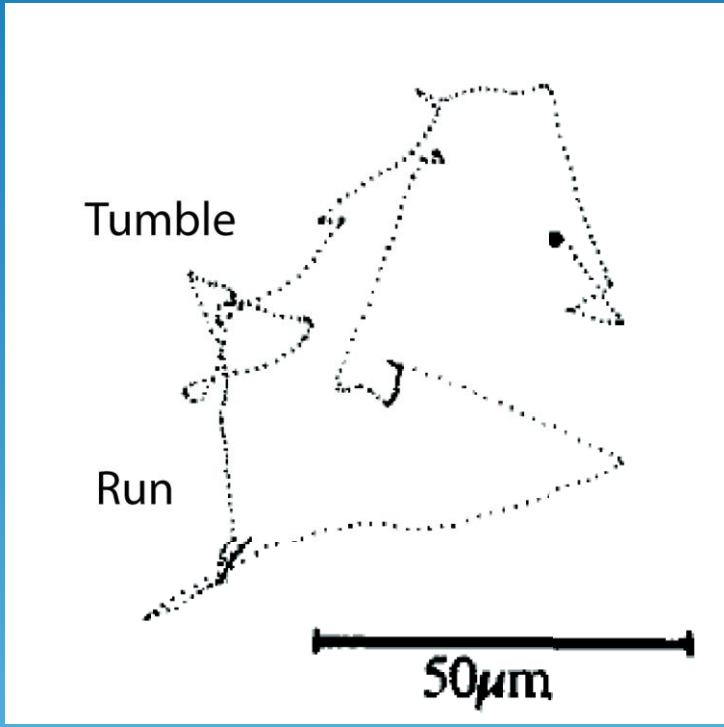

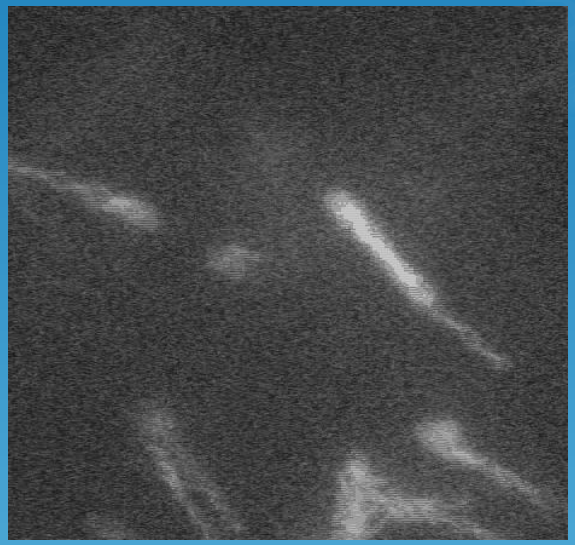

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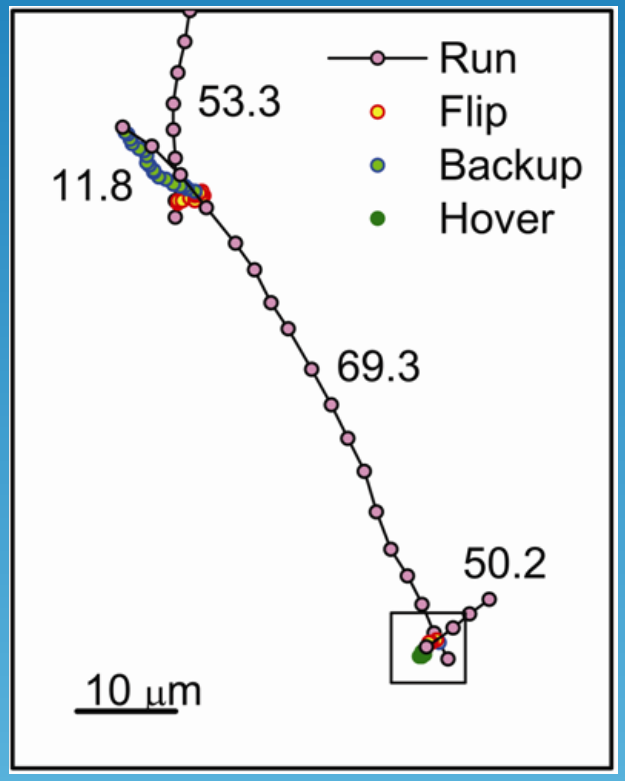
Introduction



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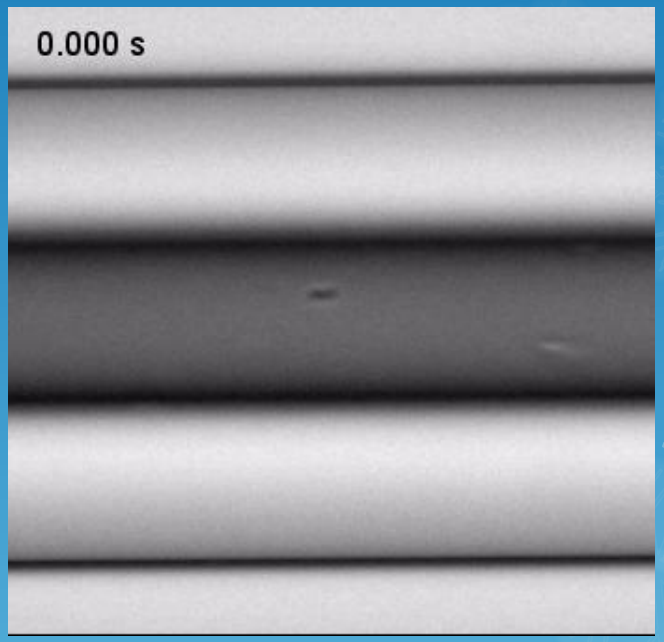
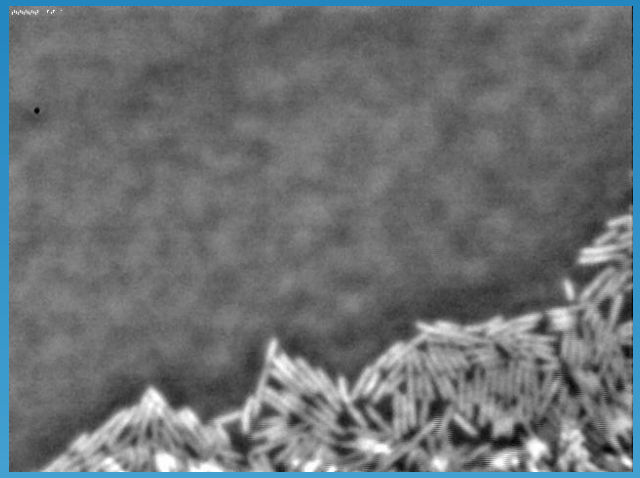


Frymier P. D. *et al*. (1995) *Proc Natl Acad Sci U.S.A.* **92**: 6195–6199
Ping L. et al. in preparation

Bacterial swarm

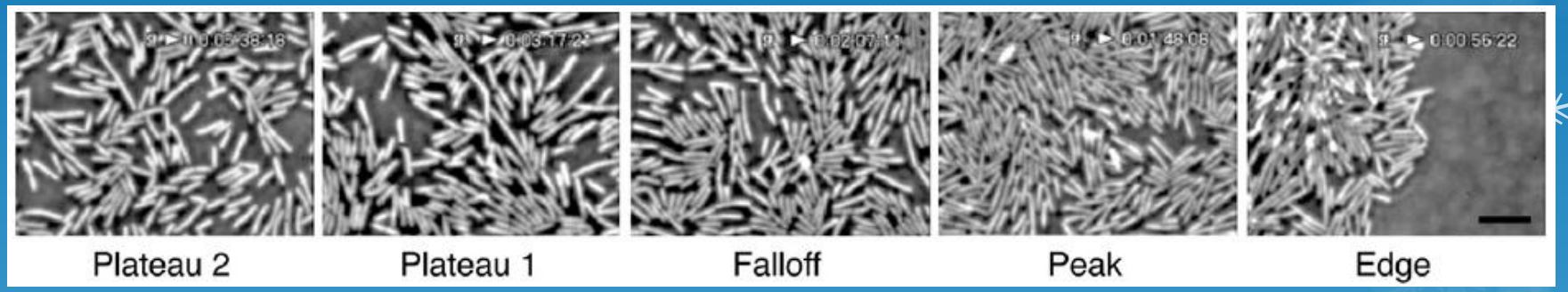


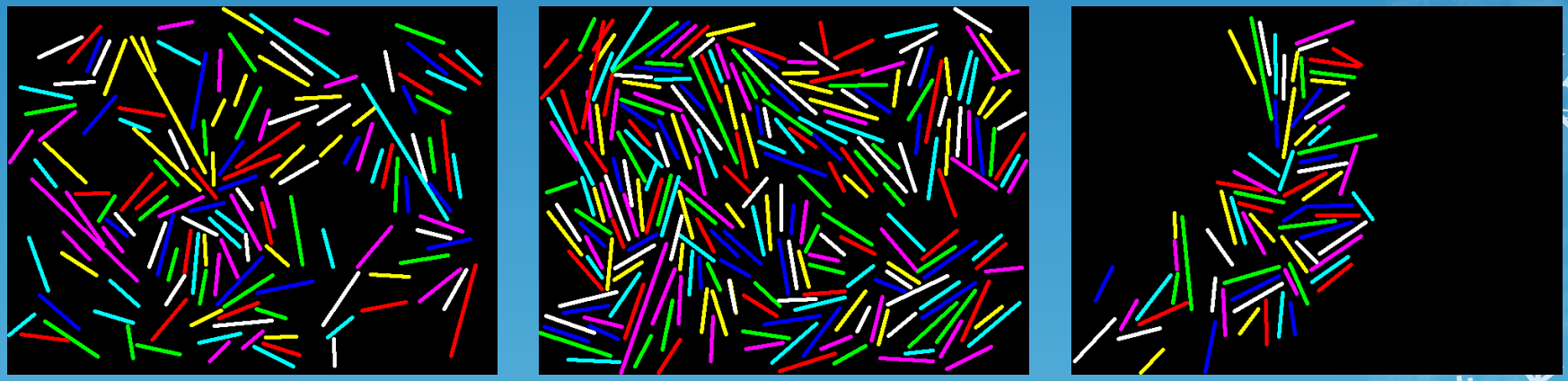
Serratia marcescens

Escherichia coli

http://www.rowland.harvard.edu/labs/bacteria/movies
Harshey R. M. (2003) *Annu. Rev. Microbiol*. **57**:249–73

Bacterial swarm





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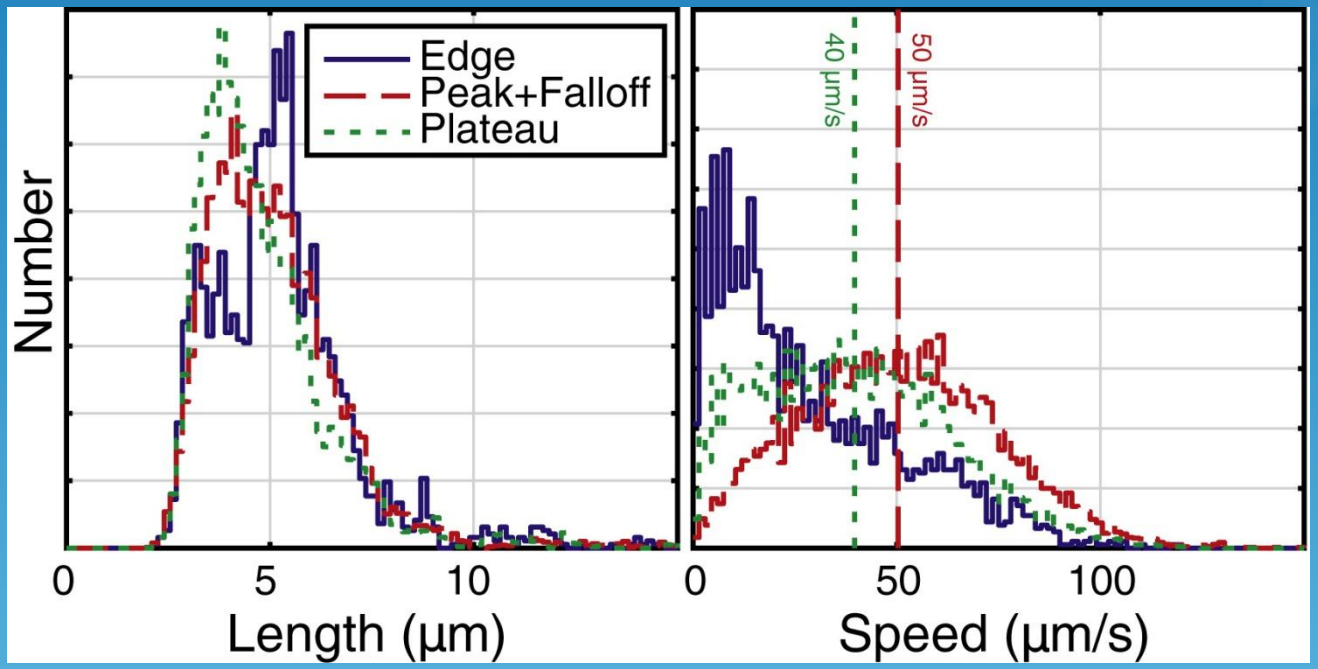
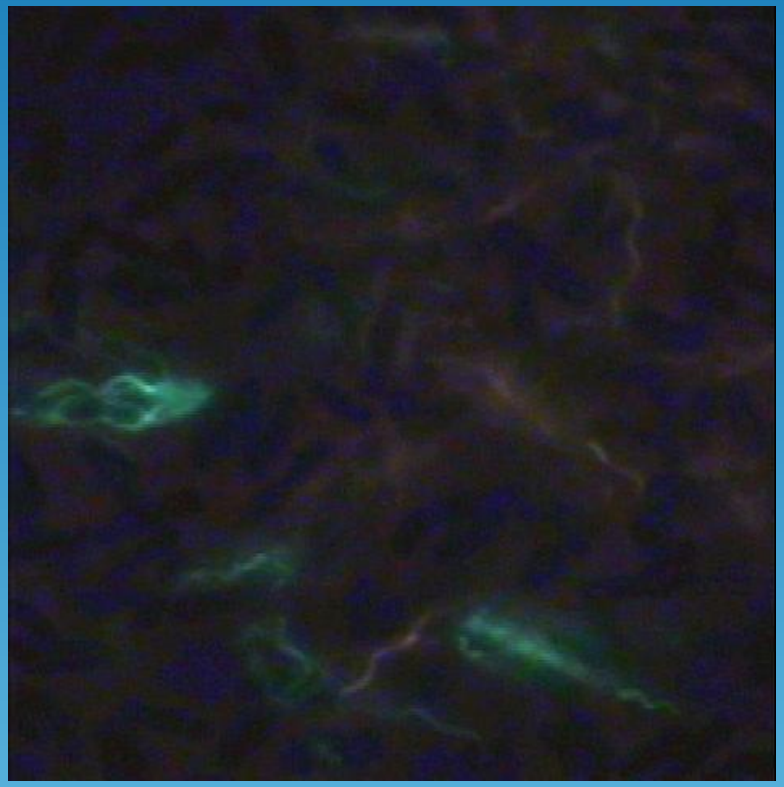
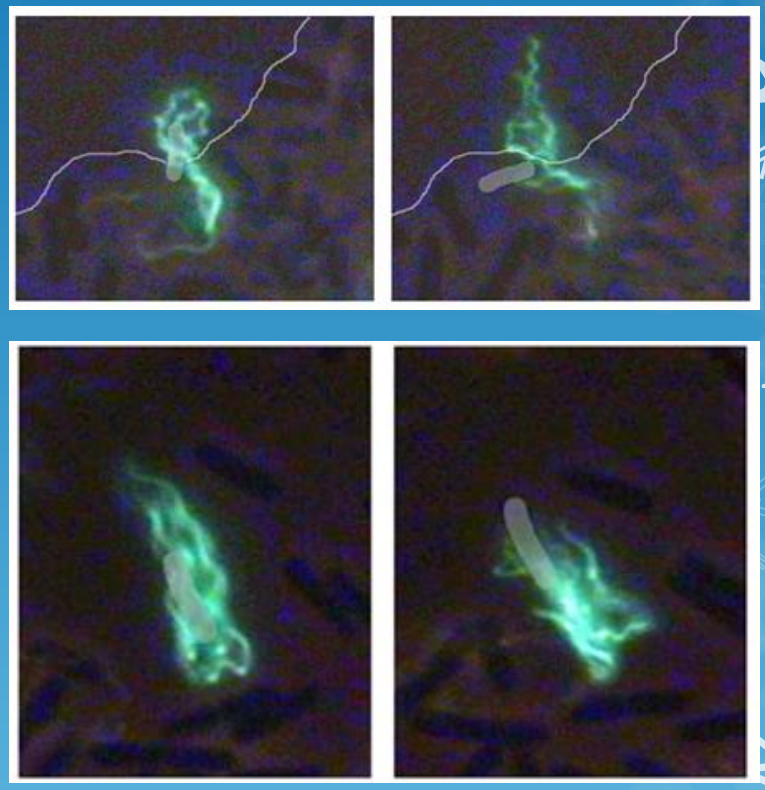


Bacterial swarm





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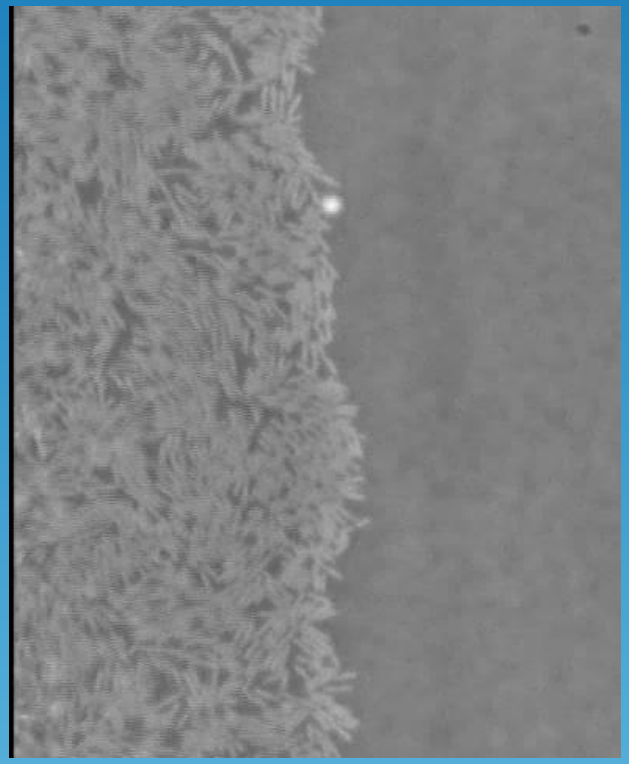
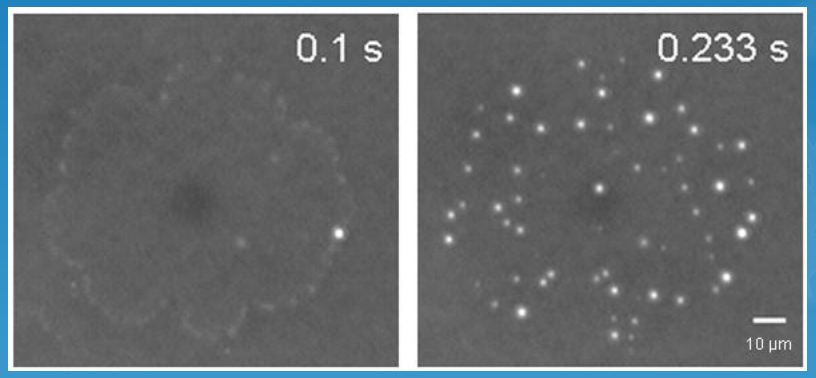
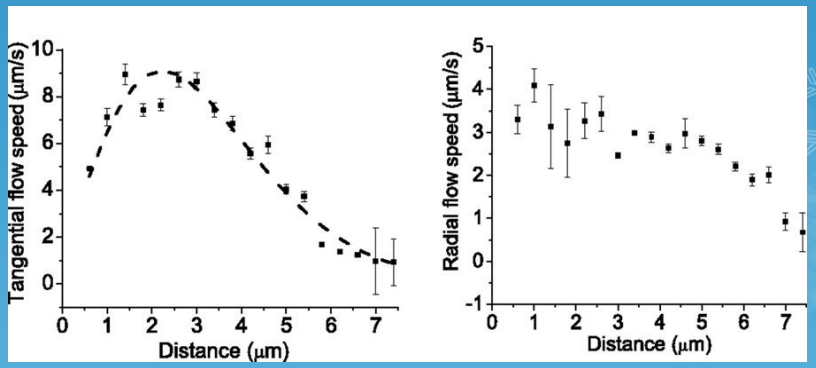
Bacterial swarm







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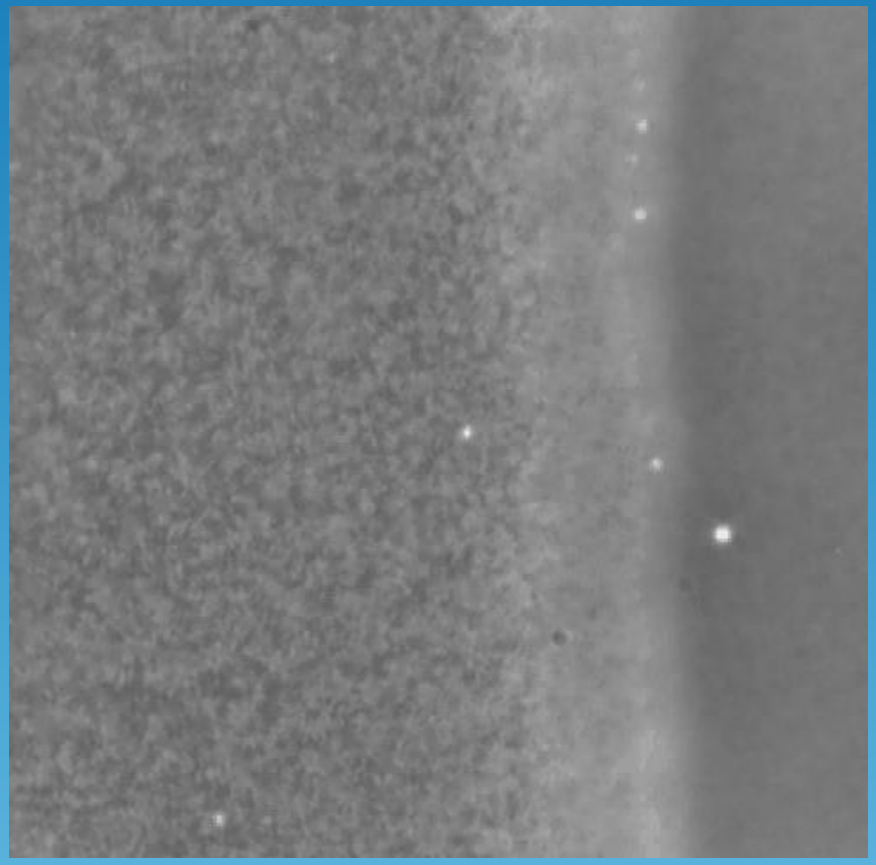
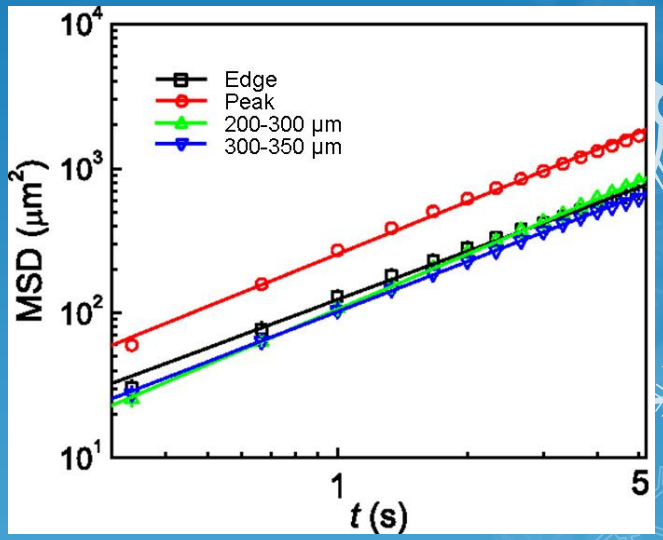
Bacterial swarm





$$\mathrm{MSD}(t) = \frac{1}{N}\sum_i^N \langle [\vec{r}_i'(\tau + t) - \vec{r}'(\tau)]^2 \rangle_\tau$$

$$\vec{r}_i'(t) = \vec{r}_i(t) - \langle \vec{r}(t) \rangle$$

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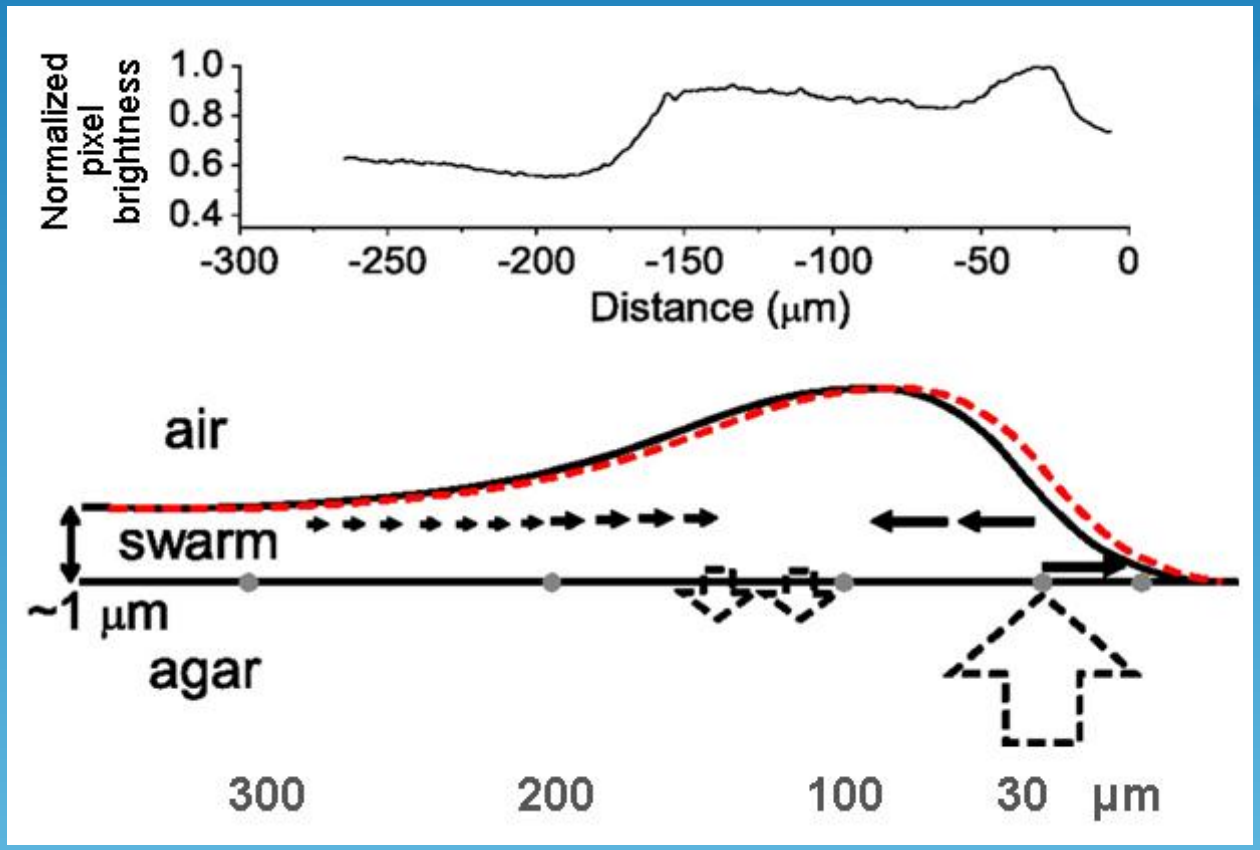
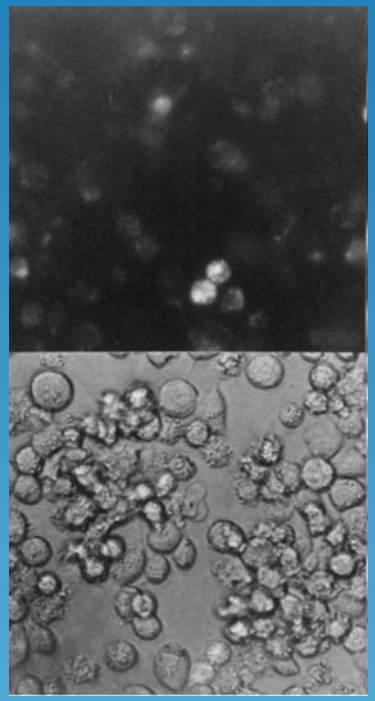
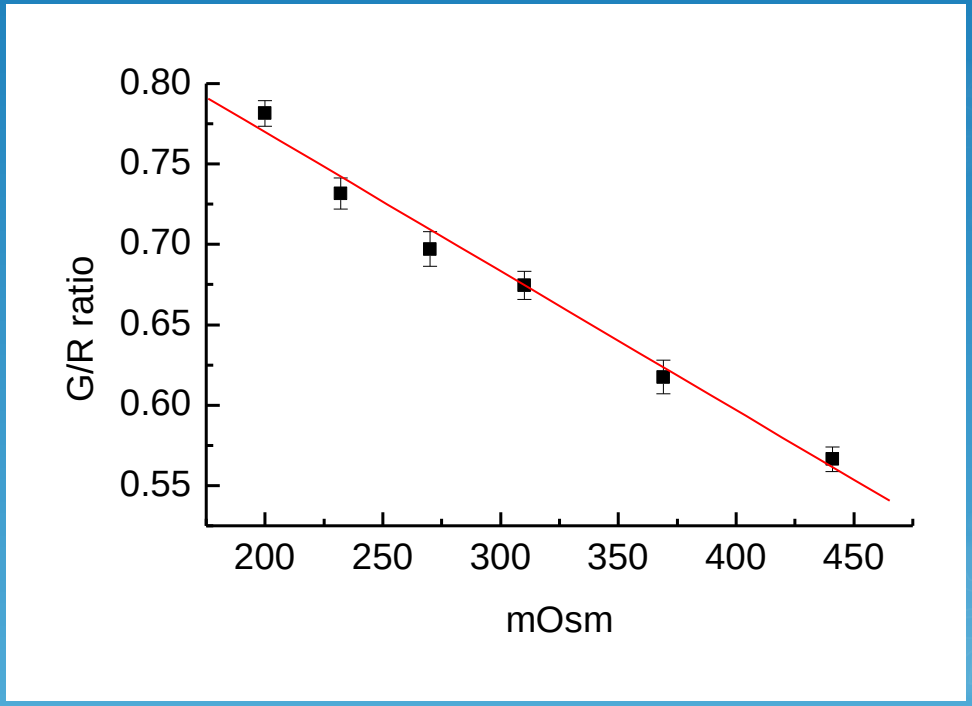
Bacterial swarm



Bacterial swarm





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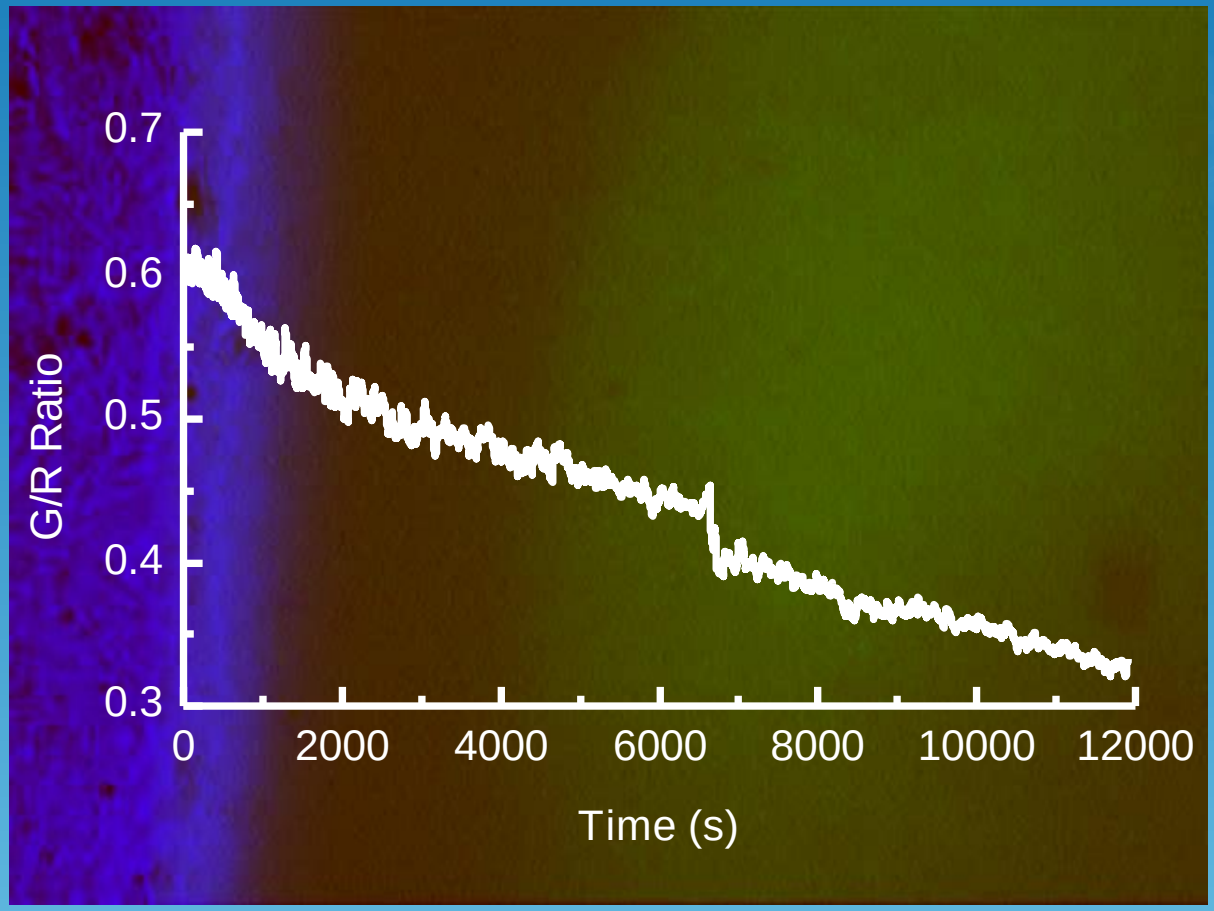
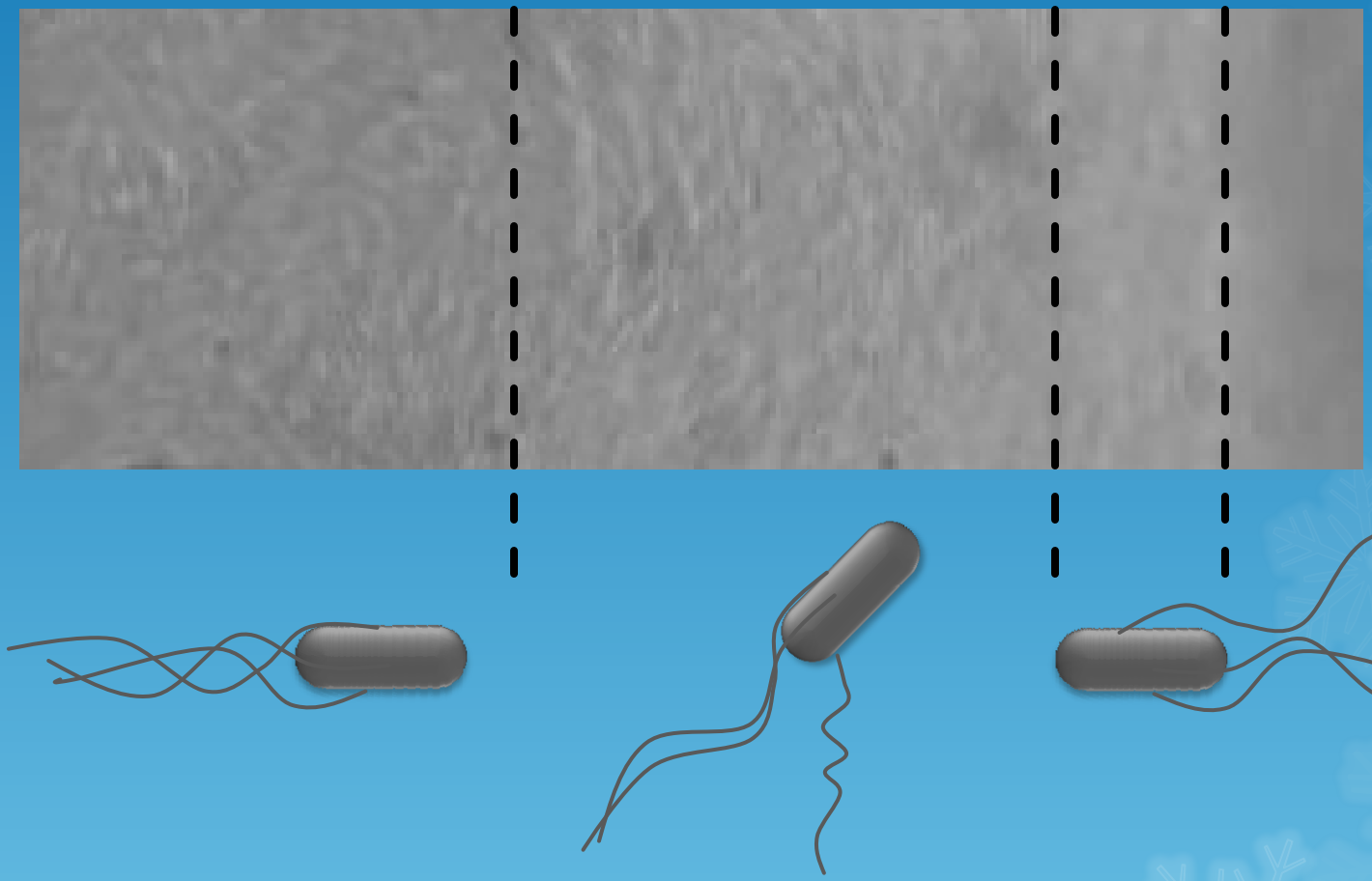
Bacterial swarm



Summary



Thank you!