

Biophysics of bacterial systems

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Please start preparing your talk and get in touch with the relevant contact about four weeks before your presentation.

Schedule

Date	Topic	Presenter
15-Nov-18	Reconstructing the cell division machinery in vitro (TB)	Natawan Gadjisade
22-Nov-18	Bacterial cell shape - sphere, rod, or banana? (BM)	Isabelle Wielert
29-Nov-18	<i>Stochastic de novo emergence of antibiotic resistance</i>	<i>Helen Alexander (Oxford)</i>
6-Dec-18	Luria-Delbrück experiments in space (JK)	Sakshi Khaiwal
13-Dec-18	Cell motility (BS)	Jonas Wassmer
20-Dec-18	Electrical signaling in bacterial communities (TB)	Timo Walter
10-Jan-19	Diversity of structured populations (JK)	Christoph Velling
17-Jan-19	Materials properties of biofilms (BM)	Mugdha Zadkar
24-Jan-19	Mutational meltdown in spatial populations (JK)	Andres Hernandez
31-Jan-19	Surface sensing (BS)	Sara Lotfipour

Topics, literature, and main contact

1. Reconstructing the cell division machinery in vitro (Tobias Bollenbach)

Zieske K¹, Schwille P¹. Reconstitution of self-organizing protein gradients as spatial cues in cell-free systems. *Elife*. 2014 Oct 1;3. doi: 10.7554/eLife.03949.

Wu F¹, Halatek J², Reiter M², Kingma E¹, Frey E³, Dekker C⁴. Multistability and dynamic transitions of intracellular Min protein patterns. *Mol Syst Biol*. 2016 Jun 8;12(6):873. doi: 10.15252/msb.20156724.

2. Bacterial cell shape - sphere, rod, or banana? (Berenike Maier)

Smith WP¹, Davit Y², Osborne JM³, Kim W⁴, Foster KR⁵, Pitt-Francis JM⁶. Cell morphology drives spatial patterning in microbial communities. *Proc Natl Acad Sci U S A*. 2017 Jan 17;114(3):E280-E286. doi: 10.1073/pnas.1613007114. Epub 2016 Dec 30.

Persat A¹, Stone HA², Gitai Z¹. The curved shape of *Caulobacter crescentus* enhances surface colonization in flow. *Nat Commun.* 2014 May 8;5:3824. doi: 10.1038/ncomms4824.

Duvernoy MC^{1,2,3}, Mora T¹, Ardré M^{1,3}, Croquette V^{1,3}, Bensimon D^{1,4,3}, Quilliet C², Ghigo JM⁵, Balland M², Beloin C⁵, Lecuyer S², Desprat N^{6,7,8}. Asymmetric adhesion of rod-shaped bacteria controls microcolony morphogenesis. *Nat Commun.* 2018 Mar 16;9(1):1120. doi: 10.1038/s41467-018-03446-y.

3. Cell motility (Benedikt Sabass)

Sabass B^{1,2}, Koch MD³, Liu G^{3,4}, Stone HA⁵, Shaevitz JW^{6,4}. Force generation by groups of migrating bacteria. *Proc Natl Acad Sci U S A.* 2017 Jul 11;114(28):7266-7271. doi: 10.1073/pnas.1621469114. Epub 2017 Jun 27. (to explain force measurement in Duvernoy et al)

Guzzo, M., Murray, S. M., Martineau, E., Lhospice, S., Baronian, G., My, L., ... & Mignot, T. (2018). A gated relaxation oscillator mediated by FrzX controls morphogenetic movements in *Myxococcus xanthus*. *Nature microbiology*, 3(8), 948.

Kranz, W. T., Gelimson, A., Zhao, K., Wong, G. C., & Golestanian, R. (2016). Effective dynamics of microorganisms that interact with their own trail. *Physical review letters*, 117(3), 038101

Duvernoy, M. C., Mora, T., Ardré, M., Croquette, V., Bensimon, D., Quilliet, C., ... & Desprat, N. (2018). Asymmetric adhesion of rod-shaped bacteria controls microcolony morphogenesis. *Nature communications*, 9(1), 1120.

4. Materials properties of biofilms (Berenike Maier)

Bonazzi D¹, Lo Schiavo V¹, Machata S¹, Djafer-Cherif I², Nivoit P¹, Manriquez V¹, Tanimoto H³, Husson J⁴, Henry N⁵, Chaté H⁶, Voituriez R⁷, Duménil G⁸. Intermittent Pili-Mediated Forces Fluidize *Neisseria meningitidis* Aggregates Promoting Vascular Colonization. *Cell.* 2018 Jun 28;174(1):143-155.e16. doi: 10.1016/j.cell.2018.04.010. Epub 2018 May 17.

Welker, A.*, Cronenberg, T.*, Zöllner, R.*, Meel, C., Siewering, K., Bender, N., Hennes, M., Oldewurtel, E.R., Maier, B., *Molecular motors govern liquid-like ordering and fusion dynamics of bacterial colonies*, *Phys. Rev. Lett.*, 121, 118102 (2018)

Oldewurtel, E.R., Kouzel, N., Dewenter, L., Henseler, K., Maier, B., *Differential interaction forces govern cell sorting in early biofilms*, [eLife;10.7554/eLife.10811](https://doi.org/10.7554/eLife.10811) (2015)

5. Active depinning of bacterial droplets (Marc Hennes)

Hennes M¹, Tailleur J¹, Charron G¹, Daerr A². Active depinning of bacterial droplets: The collective surfing of *Bacillus subtilis*. *Proc Natl Acad Sci U S A.* 2017 Jun 6;114(23):5958-5963. doi: 10.1073/pnas.1703997114. Epub 2017 May 23.

6. Electrical signaling in bacterial communities (Tobias Bollenbach)

Prindle A, Liu J, Asally M, Ly S, Garcia-Ojalvo J & Süel GM (2015) Ion channels enable electrical communication in bacterial communities. *Nature* 527: 59–63 Available at: <http://www.nature.com/doi/10.1038/nature15709>

Liu J, Prindle A, Humphries J, Gabalda-Sagarra M, Asally M, Lee DD, Ly S, Garcia-Ojalvo J & Süel GM (2015) Metabolic co-dependence gives rise to collective oscillations within biofilms. *Nature* 523: 550–554 Available at: <http://www.nature.com/doi/10.1038/nature14660>

Larkin JW, Zhai X, Kikuchi K, Redford SE, Prindle A, Liu J, Greenfield S, Walczak AM, Garcia-Ojalvo J, Mugler A & Süel GM (2018) Signal Percolation within a Bacterial Community. *Cell Syst.* 7: 137–145.e3 Available at: <https://linkinghub.elsevier.com/retrieve/pii/S240547121830245X>

7. Diversity of structured populations (Joachim Krug)

Reichenbach T¹, Mobilia M, Frey E., Mobility promotes and jeopardizes biodiversity in rock-paper-scissors games. *Nature*. 2007 Aug 30;448(7157):1046-9.

Weber MF¹, Poxleitner G, Hebisch E, Frey E, Opitz M., Chemical warfare and survival strategies in bacterial range expansions. *J R Soc Interface*. 2014 May 7;11(96):20140172. doi: 10.1098/rsif.2014.0172. Print 2014 Jul 6.

8. Mutational meltdown in spatial populations (Joachim Krug)

Lavrentovich MO, Wahl ME, Nelson DR, Murray AW, Spatially Constrained Growth Enhances Conversional Meltdown. *Biophysical Journal* 110:2800-2808 (2016). <http://dx.doi.org/10.1016/j.bpj.2016.05.024>

Park SC, Klatt P, Krug J, Rare beneficial mutations cannot halt Muller's ratchet in spatial populations. *EPL* 123:48001 (2018). <https://doi.org/10.1209/0295-5075/123/48001>

9. Luria-Delbrück experiments in space (Joachim Krug)

Fusco D, Gralka M, Kayser J, Anderson A, Hallatschek O, Excess of mutational jackpot events in expanding populations revealed by spatial Luria–Delbrück experiments. *Nature Communications* 7:127160 (2016)

Hallatschek, O, Hersen, P, Ramanathan, s, Nelson, DR, Genetic drift at expanding frontiers promotes gene segregation. *Proc. Natl Acad. Sci.* 104, 19926–19930 (2007).

10. Surface sensing (Benedikt Sabass)

Berne C¹, Ellison CK¹, Ducret A², Brun YV³. Bacterial adhesion at the single-cell level., *Nat Rev Microbiol.* 2018 Jul 15. doi: 10.1038/s41579-018-0057-5. [Epub ahead of print]

Ellison CK¹, Kan J^{2,3}, Dillard RS⁴, Kysela DT¹, Ducret A⁵, Berne C¹, Hampton CM⁴, Ke Z^{4,6}, Wright ER⁴, Biais N^{2,3}, Dalia AB¹, Brun YV⁷. Obstruction of pilus retraction stimulates bacterial surface sensing. *Science*. 2017 Oct 27;358(6362):535-538. doi: 10.1126/science.aan5706.