The newly created Dioscuri Centre for Physics and Chemistry of Bacteria invites applications for a PhD position in computational modelling of intracellular bacterial colonies.

Bacteria are ubiquitous in nature. Many bacteria live on and inside animals and humans, but only a small fraction of them cause diseases. In an infection, bacteria often form intracellular bacterial colonies (IBCs) inside animal cells. The biology of IBCs is well understood [1]. However, we still do not know how physical and chemical processes (mechanical forces, cellular motility, chemical gradients) affect the growth and evolution of IBCs.

Physics has been shown to play an important role in bacterial colonies and biofilms on abiotic surfaces (agar, glass). In particular, factors such as cell shape, rigidity, mechanical interactions with other bacteria and their environment are very important for the ecology and evolution of bacteria in such conglomerates [2-4]. However, the role of these factors in IBCs is unclear.

Although experiments remain the most important tool in studying IBCs, computer models of bacterial colonies are useful because many interactions are difficult to directly probe experimentally. A model can be used to test whether a combination of difficult-to-measure interactions leads to an experimentally observable effect; this can provide an indirect way to better understand these interactions.

[1] A. L. Flores-Mireles, J. N. Walker, M. Caparon, and S. J. Hultgren, Nat. Rev. Microbiol. **13**, 269 (2015)
[2] F. D. C. Farrell, O. Hallatschek, D. Marenduzzo, and B. Waclaw, Phys. Rev. Lett. **111**, (2013)
[3] M. Gralka, F. Stiewe, F. Farrell, W. Möbius, B. Waclaw, and O. Hallatschek, Ecol. Lett. **19**, 889 (2016)
[4] F. D. Farrell, M. Gralka, O. Hallatschek, and B. Waclaw, J. R. Soc. Interface **14**, 20170073 (2017)

Objectives. You will develop mechanistic, predictive models of *E. coli* IBCs in urothelial cells of the bladder. Your project will expand on the existing model of bacterial colonies [2-4] and include interactions between two types of “active soft matter”: the bacterial colony and the interior of the animal cell (cytoplasm, membranes, surface proteins), as well as the relevant biochemistry (diffusion, signalling, gene regulation). Your model will be informed by, and tested in in-house experiments.

Requirements for applicants. Msc in mathematics, informatics, physics, chemistry, or engineering. Very good English. Very good programming skills (any language). Very good academic achievements and a strong motivation to learn the required biology. Ability to work with people from diverse background (cultural and scientific). The candidate is expected to work closely with other modellers and experimentalists from the Dioscuri Centre and the Soft Condensed Matter group (Prof. R. Holyst), and with theorists from the Department of Evolutionary Theory in MPI in Ploen, Germany (Prof. A. Traulsen). Regular visits to Ploen (a few weeks/year), Edinburgh (B. Waclaw’s previous research group), participation in national and international conferences and in internal seminars/group discussions will be required.

Salary. Tax-free doctoral school scholarship (approximately 2100 PLN/month, 3200 PLN/month following successful mid-term evaluation). In addition, the Dioscuri Centre will supplement the scholarship with up to 10,000 EUR/year (830 EUR/month).

How to apply: submit application via http://warsaw4phd.eu/en/candidates/admissions/

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http://groups.ichf.edu.pl/holyst
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