UNI BASEL

BIOZENTRUM
Universität Basel
The Center for
Molecular Life Sciences

Master thesis / internship (2021-2022): quantitative biology of non-growing bacteria.

Although bacteria in the wild likely spend the majority of their time in non-growing states, relatively little is known about cell physiology and gene expression in such states, especially at the single-cell level. For instance, it is not known whether constant population size during stationary phase corresponds to the fact that all cells stopped growing and dividing, or to a balance between slow growth and mortality. It has also been reported that constitutive genes remain expressed at low level in such conditions, but it is not clear yet how this production is balanced so that protein concentration appears to be stable.

Our lab uses a combination of experimental and theoretical approaches to study growth and gene expression at the single-cell level in bacteria. We have developed a microfluidic system that allows us to measure growth, division and gene expression of single cells in a dynamically changing environment [1]. In this internship, the student will use this integrated setup to study conditions where bacterial populations are not growing (minimal medium deprived of one necessary nutrient, stationary phase culture flown to the microfluidic device, etc). The focus will be to characterize the differences between different types of growth arrest – with the aim to pinpoint the underlying molecular mechanisms. In particular we want to understand why certain growth-arrest conditions allow rare subpopulations to stochastically regrow while others don't.

The student will be in charge of running the experiments in which bacteria carrying fluorescent reporters are grown inside a microfluidic device and followed using time-lapse microscopy, he/she will learn to process their data with our image analysis pipeline, and will help implement quantitative data analysis procedures aimed to characterize the physiological state of growth arrested bacteria. Depending on the student's abilities and interest, the work can be extended to include computational modeling. Moreover, competitive funding is available for motivated students desiring to start a PhD after the internship (in particular Biozentrum's "Fellowships for Excellence").

The van Nimwegen Lab [2] at Basel University's Biozentrum is an international and multidisciplinary team with extensive expertise in the study of transcription regulation and cell-to-cell variability. A list of our group's publications can be found on Google Scholar [3]. Our computational and experimental groups work together to combine cutting edge statistical and computational tools with quantitative experiments.

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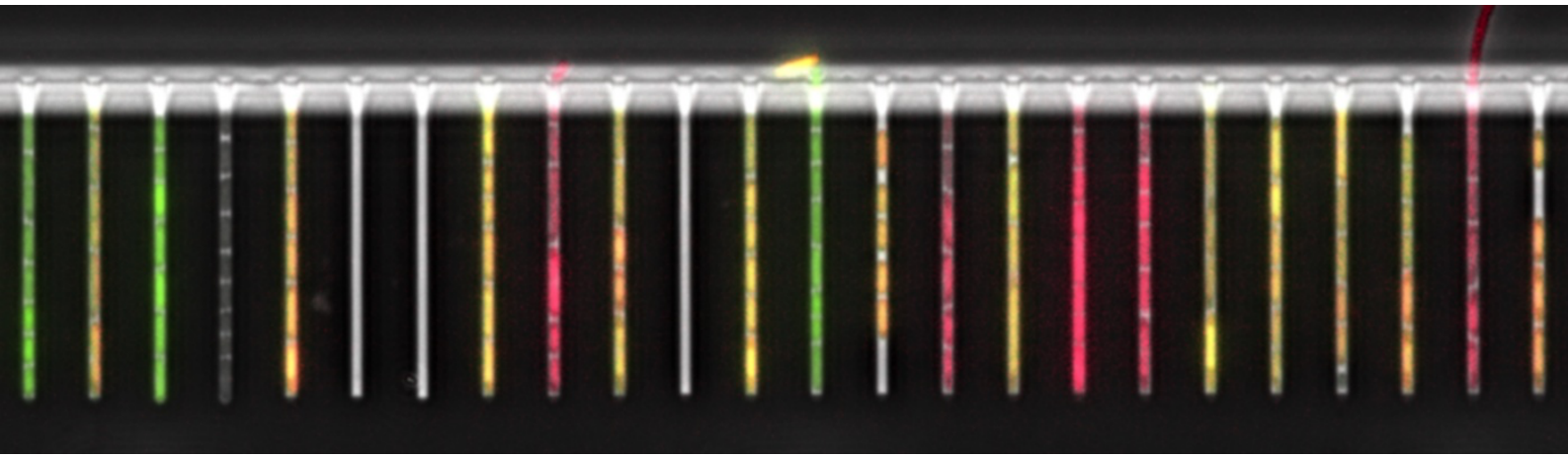

[1] Kaiser M*, Jug F*, Julou T*, *et al*. (2018) *Nat Commun* 9, 212.
[2] http://www.biozentrum.unibas.ch/nimwegen/
[3] http://scholar.google.ch/citations?user=N24KB1wAAAAJ