

Bachelor-Abschlussarbeit

Thema der Abschlussarbeit:

Individual-based Modelling of Quorum Sensing Regulated EPS Production in Biofilms

Zusammenfassung:

Quorum Sensing is a bacterial cell-cell communication mechanism based on the cell density. It enables bacteria to coordinate group behaviour and change gene expression for example the excretion of extracellular polymeric substances. Extracellular polymeric substances may be produced by bacteria in the biofilm mode of growth. It acts as a scaffold for the biofilm, as protection and external digestive system.

In this in-silico work the competition of two different bacterial strains had been investigated with the help of an Individual-based model. The strains differ in their ability to produce extracellular polymeric substances (EPS), one is able to do so (EPS+) and the other one is not (EPS-). The EPS+ strain was also permanently equipped with a Quorum Sensing system which mediated EPS production. Two different Quorum Sensing strategies were modelled: a down-regulation strategy, where EPS production is ceased when a high concentration of Quorum Sensing molecules is reached and an up-regulation strategy, where EPS production is initiated only when a high concentration of Quorum Sensing molecules is reached. For both these Quorum Sensing strategies two different cases were compared: case 1 in which both strains are producing Quorum Sensing molecules but only the EPS+ strain is able to utilise them and case 2 in which only the EPS+ strain produces Quorum Sensing molecules. It was found that the EPS+ strain was displaying higher values for relative fitness in case 1, originating from an exploitation of the EPS- strain. However it could not be proven that this exploitation scenario is beneficial in every scenario: the earlier regulation of EPS production may lead to an disadvantage in some cases. It was also found that the time in which EPS was produced correlates positively to the relative fitness.

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