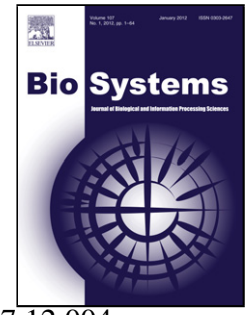

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Modular assembling process of an in-silico protocell

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Abstract

The bottom-up approach of synthetic biology is driven by the need for a deepened understanding of the interaction of functional modules in living or artificial systems. The hope is that the gained knowledge will help to optimize existing systems, or, as one long-term goal of synthetic biology, to build up artificial cell-like entities from single building blocks. This article focuses on a system theoretic approach to synthetic biology, and in particular on the construction of a protocell model by the modular assembling process. Different models for an in-silico protocell are described that combines experimentally validated biological subsystems with theoretical assumptions. The in-silico protocell that is characterized consists of three different functional modules: the membrane proliferating module, the membrane contraction module, and a positioning module. Additional theoretical hypotheses are tested in order to merge the module models to one protocell model with synchronously working parts. The different approaches used here for developing a protocell model could be helpful for assembling the different modules to one system in reality. Depending on the objective one wants to achieve a more or less detailed modeling approach is appropriate.

Keywords: bottom-up approach, synthetic biology, artificial cell, systems engineering, system analysis, mathematical modeling, simulation

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