

# Computational approaches in synthetic and systems biology

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## Abstract

Computational biology is an emerging scientific field which employs computational methods in the study of various biological systems. This chapter presents a review of methods that have been introduced to the fields of synthetic and systems biology in recent years. Approaches presented mainly rely on the establishment of computational models. These models allow us to observe the behaviour of a certain biological system in a given environment. Exact kinetic data that describe underlying dynamics are usually necessary to establish accurate computational models. Kinetic data are on the other hand hard or even impossible to obtain experimentally in some cases. Parameter estimation techniques that also rely on computational approaches can be used to accurately evaluate missing kinetic data. With the establishment of computational models, computational analyses can be conducted, such as performance, robustness, sensitivity or stability analysis. These techniques can be used further on to reduce the amount of experimental work and enable straightforward design of novel biological systems in the context of synthetic biology.

**Keywords:** computational modelling, computer simulation, network inference, parameter estimation techniques, performance evaluation, sensitivity analysis, stability analysis, computational design