

Novel modelling formalisms and simulation tools in Computational Biosystems

Bioengineering Systems PhD

UMinho

Background: **MSc. Mathematics and Computer Science,**
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Starting Year: **2007 / 2008**

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Objectives

- Integration of different kinds of biological networks.
- Creation of a common modelling framework.
- Support for analysis, simulation and optimization.
- Focus on Metabolic Engineering applications (Fig. 1)..

Work Plan

- Review modelling formalisms used in Systems Biology.
- Select suitable formalism to create a modelling framework.
- Development of analysis and simulation tools in this framework.
- Implement integrated regulatory and metabolic model of E.coli.
- Experimental validation using bench-scale bioreactors.

Results

Initial research covered mathematical and computational formalisms used in Systems Biology (such as differential equations, boolean networks and process algebras). Petri nets (Fig. 2) are a sound mathematical and graphical formalism with different extensions available, providing the flexibility required to integrate different types of networks. Examples found in the literature cover analysis and simulation of all major kinds of networks (metabolic, regulatory and signalling.)



Fig. 1. Biotechnological production.

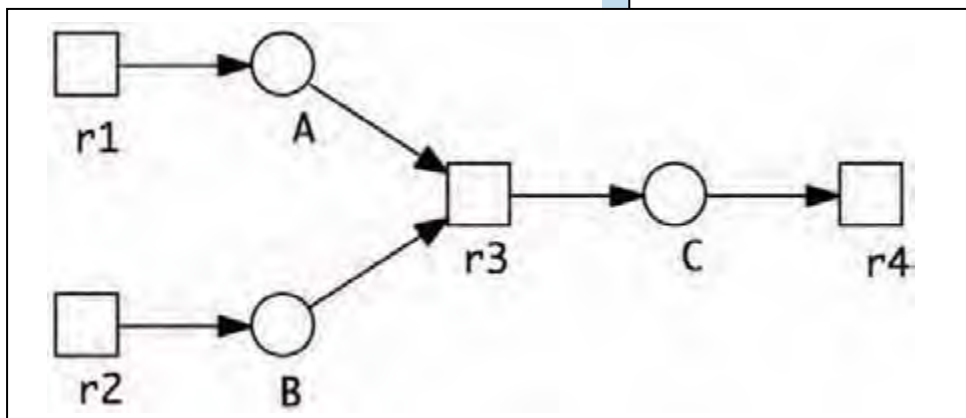


Fig. 2. Petri net model of a small metabolic network.

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