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**Overview of Agent-Based Tools for Modelling of Biological
Systems and their Application to the Analysis of Multi-Cellular
Biological Oscillator**
ABSTRACT

In this thesis, we overview computational tools for agent-based modelling of biological systems. Agent-based modelling focuses on the modelling of observed system with individual components called agents. This type of modelling offers a representation of a biological system at multiple levels of abstraction. We overview general-purpose agent-based framework and agent-based tools, which use cells as the primary agents. We compare and examine available tools from different perspectives. We examine how agent dynamics can be modelled, and properties of modelling languages, simulated environments, and built-in complex cellular traits (e.g. growth and movement) are checked. Afterwards, we examine NetLogo, BSim, Gro, and CellModeller framework. For each tool we provide description of their interactive environment, properties of modelling language, and their design and implementation principles. In the last part, we perform analysis of the above mentioned tools on the case study of a multi-cellular biological oscillator model. We conclude with the agent-based framework proposition, which would simplify the process of implementation of multi-agent biological models.

Key words: agent-based modelling, multicellular modelling, simulation, biological systems, emergent behaviour, oscillator.