LITHUANIAN COMPUTER SOCIETY
VILNIUS UNIVERSITY
INSTITUTE OF DATA SCIENCE AND DIGITAL TECHNOLOGIES
LITHUANIAN ACADEMY OF SCIENCES


13th Conference on

# DATA ANALYSIS METHODS FOR SOFTWARE SYSTEMS

Druskininkai, Lithuania, Hotel "Europa Royale"
https://www.mii.lt/DAMSS

**December 1–3, 2022**

VILNIUS UNIVERSITY PRESS
Vilnius, 2022

**Co-Chairmen:**

Dr. Saulius Maskeliūnas (Lithuanian Computer Society)
Prof. Gintautas Dzemyda (Vilnius University, Lithuanian Academy of Sciences)

**Programme Committee:**

Prof. Juris Borzovs (Latvia)
Dr. Jolita Bernatavičienė (Lithuania)
Prof. Robertas Damaševičius (Lithuania)
Prof. Janis Grundspenkis (Latvia)
Prof. Janusz Kacprzyk (Poland)
Prof. Ignacy Kaliszewski (Poland)
Prof. Bożena Kostek (Poland)
Prof. Tomas Krilavičius (Lithuania)
Prof. Olga Kurasova (Lithuania)
Prof. Julius Žilinskas (Lithuania)

**Organizing Committee:**

Dr. Jolita Bernatavičienė
Prof. Olga Kurasova
Dr. Viktor Medvedev
Dr. Martynas Sabaliauskas
Prof. Povilas Treigys
Laima Paliulionienė

**Contacts:**

Dr. Jolita Bernatavičienė
*jolita.bernataviciene@mif.vu.lt*
Tel. +370 5 2109 315



https://doi.org/10.15388/DAMSS.13.2022
ISBN 978-609-07-0794-4 (print)
ISBN 978-609-07-0795-1 (digital PDF)

# Influence of Oxygen Consumption Rate Modulation on Bacterial Pattern Formation Models

Boleslovas Dapkūnas, Romas Baronas, Žilvinas Ledas

Institute of Computer Science
Vilnius University

*boleslovas.dapkunas@mif.vu.lt*

Mathematical bacterial pattern formation models have been studied since the 1970s. Most models are based on Keller-Segel equations. In this approach, the dynamics of the bacteria population is modelled using a system of nonlinear reaction-diffusion-chemotaxis partial differential equations.

*Escherichia coli* exhibits attraction to self-excreted chemoattractant. It was also shown that the activity of *E. coli* depends on available oxygen. The dynamics of oxygen consumption rate play an important part in the pattern formation. Multiple methods of oxygen consumption rate modulation have been used in different studies. The interactions between several active processes lead to very complex dynamic systems that are still poorly understood.

The aim of this work is to examine the effects of several different oxygen consumption rate modulation functions on the spatiotemporal pattern formation of luminous bacteria. The model involving chemoattractant and oxygen dynamics is used to simulate the 2D patterns in bacterial populations near the inner lateral surface of a cylindrical micro-container. The numerical simulation was conducted using the finite difference technique.