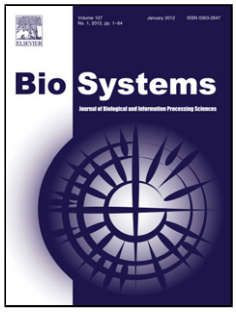

Title: Slime mould: the fundamental mechanisms of biological cognition

Author: Jordi Vallverdú Oscar Castro Richard Mayne Max Talanov Michael Levin Frantisek Baluška Yukio Gunji Audrey Dussutour Hector Zenil Andrew Adamatzky

PII: S0303-2647(17)30457-4
DOI: https://doi.org/doi:10.1016/j.biosystems.2017.12.011
Reference: BIO 3823

To appear in: *BioSystems*

Received date: 1-12-2017
Revised date: 18-12-2017
Accepted date: 20-12-2017

Please cite this article as: Jordi Vallverdú, Oscar Castro, Richard Mayne, Max Talanov, Michael Levin, Frantisek Baluška, Yukio Gunji, Audrey Dussutour, Hector Zenil, Andrew Adamatzky, Slime mould: the fundamental mechanisms of biological cognition, *<![CDATA[BioSystems]]>* (2018), https://doi.org/10.1016/j.biosystems.2017.12.011

Slime mould: the fundamental mechanisms of biological cognition

Jordi Vallverdú[a], Oscar Castro[a], Richard Mayne[c], Max Talanov[b], Michael Levin[f], Frantisek Baluška[e], Yukio Gunji[d], Audrey Dussutour[g], Hector Zenil[h], Andrew Adamatzky[c]

[a]*Department of Philosophy, Universitat Autònoma de Barcelona, Catalonia*
[b]*Kazan Federal University, Kazan, Russia*
[c]*Unconventional Computing Centre, University of the West of England, Bristol, UK*
[d]*Waseda University, Tokyo, Japan*
[e]*Institute of Cellular and Molecular Botany, University of Bonn, Germany*
[f]*Allen Discovery Center, Tufts University, Medford, MA,USA*
[g]*Universite Paul Sabatier, Toulouse, France*
[h]*Algorithmic Dynamics Lab, SciLifeLab, Karolinska Institute, Stockholm, Sweden*

Abstract

The slime mould *Physarum polycephalum* has been used in developing unconventional computing devices for in which the slime mould played a role of a sensing, actuating, and computing device. These devices treated the slime mould rather as an active living substrate yet the slime mould is a self-consistent living creature which evolved for millions of years and occupied most part of the world, but in any case, that living entity did not own true cognition, just automated biochemical mechanisms. To "rehabilitate" the slime mould from the rank of a purely living electronics element to a "creature of thoughts" we are analyzing the cognitive potential of *P. polycephalum*. We base our theory of minimal cognition of the slime mould on a bottom-up approach, from the biological and biophysical nature of the slime mould and its regulatory systems using frameworks suh as Lyons biogenic cognition, Muller, di Primio-Lengelerś modifiable pathways, Bateson's "patterns that connect" framework, Maturanas autopoetic network, or proto-consciousness and Morgans Canon.

Keywords: consciousness, cognition, slime mould