Cooperation in space: solving a problem by adding a layer

Introduction

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Glossary

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Frénoy et al., 2017

ORIGINAL ARTICLE

doi:10.1111/evo.13279

Second-order cooperation: Cooperative offspring as a living public good arising from second-order selection on non-cooperative individuals

Antoine Frénoy,[1,2,3] François Taddei,[2] and Dusan Misevic[2]

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Living public good

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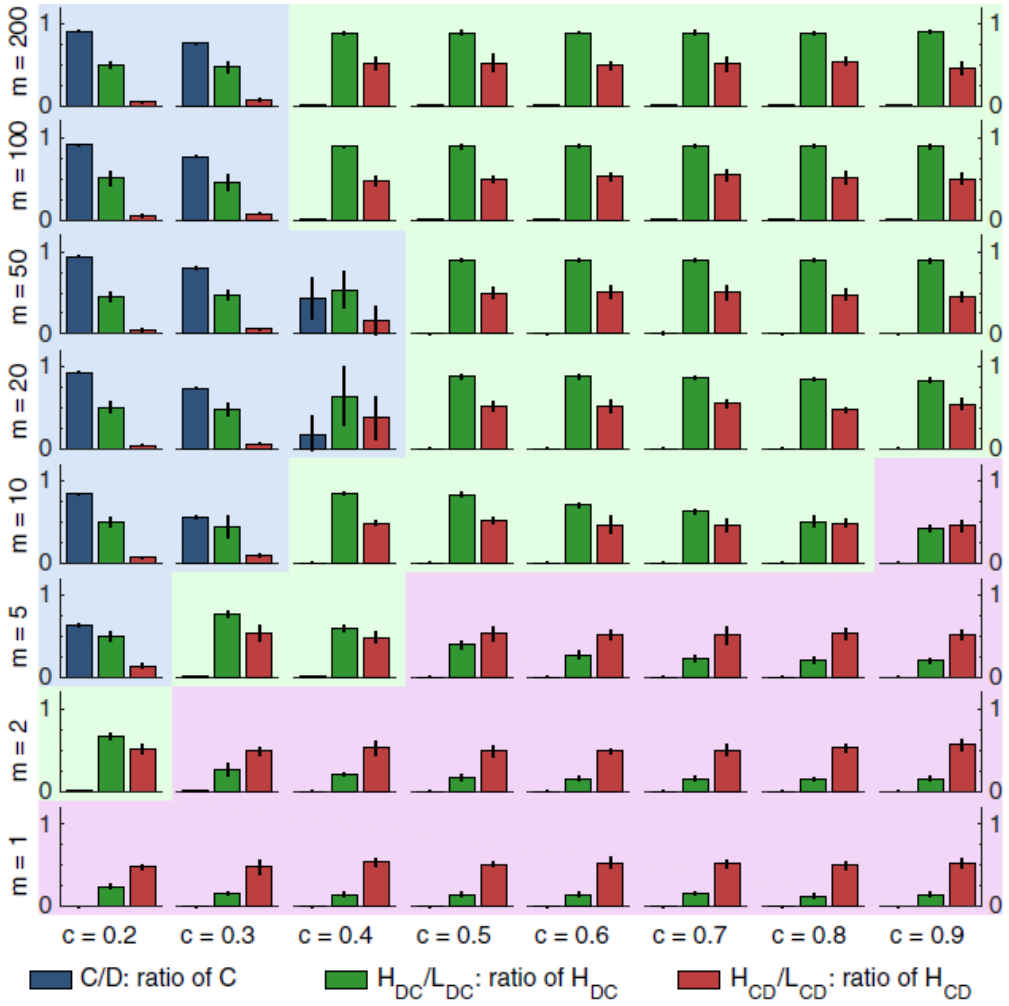
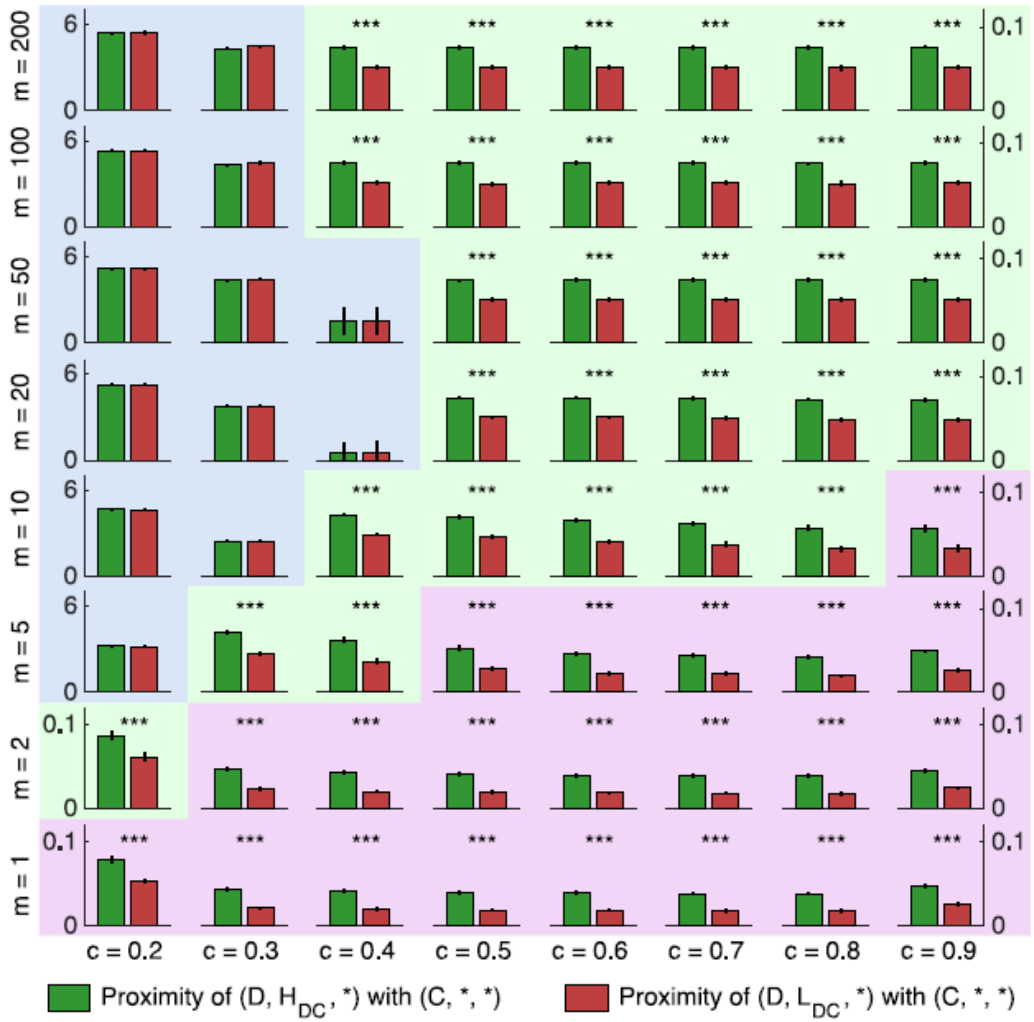
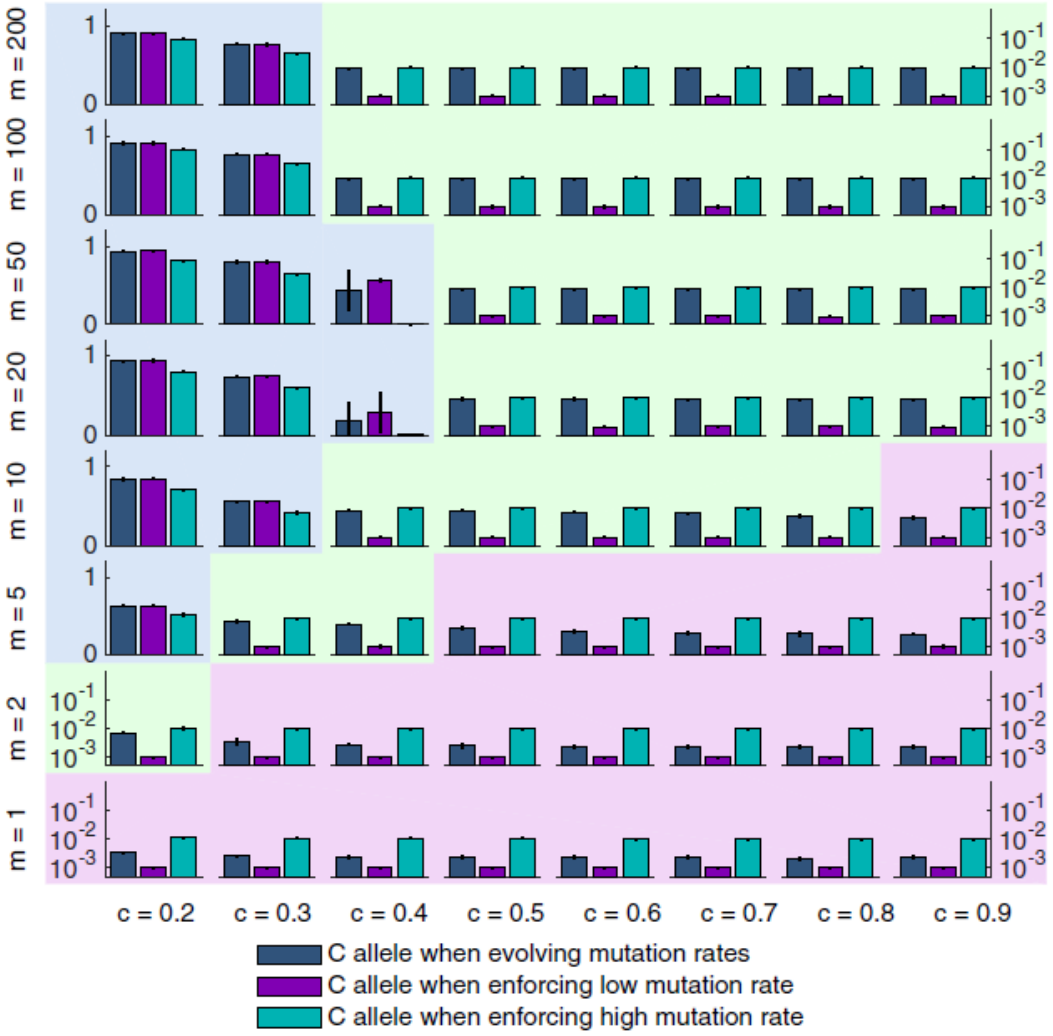
Three regions arise



Spatial association



Fixed mutation rates



Comparisons

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Lewin-Epstein et al., 2017

nature COMMUNICATIONS

ARTICLE

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DOI: 10.1038/ncomms14040 OPEN

Microbes can help explain the evolution of host altruism

Ohad Lewin-Epstein[1,*], Ranit Aharonov[1,†,*] & Lilach Hadany[1]

Microbe-guided altruism

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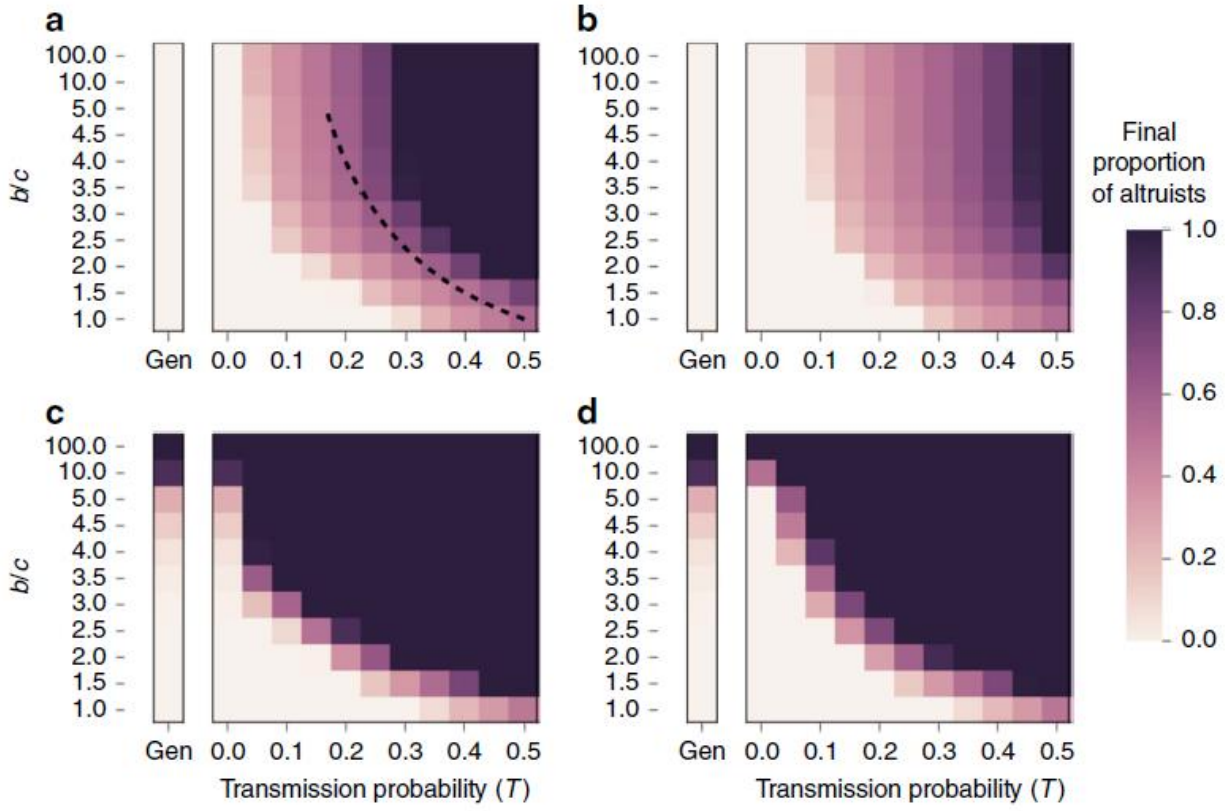
$$\frac{b}{c} > \frac{1-T}{T}$$

Results in space



Models vs stories

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Comparisons

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Joshi et al., 2017

PLOS | COMPUTATIONAL BIOLOGY

RESEARCH ARTICLE

Mobility can promote the evolution of cooperation via emergent self-assortment dynamics

Jaideep Joshi[1]*, Iain D Couzin[2,3], Simon A Levin[4], Vishwesha Guttal[1]*

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Mobility + Self-assortment

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Individual based evolutionary model

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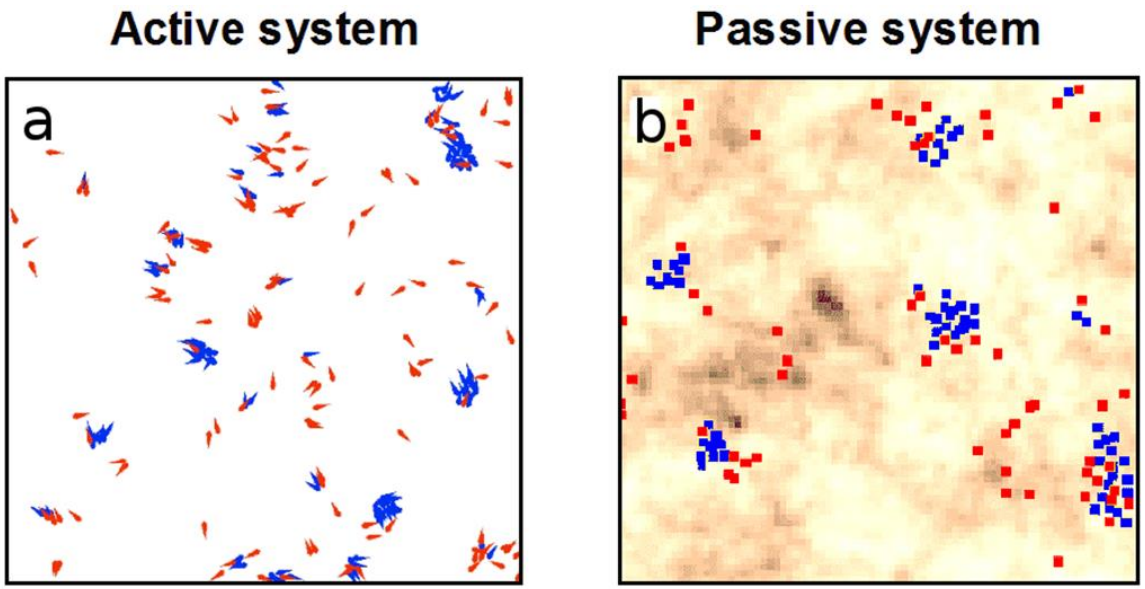
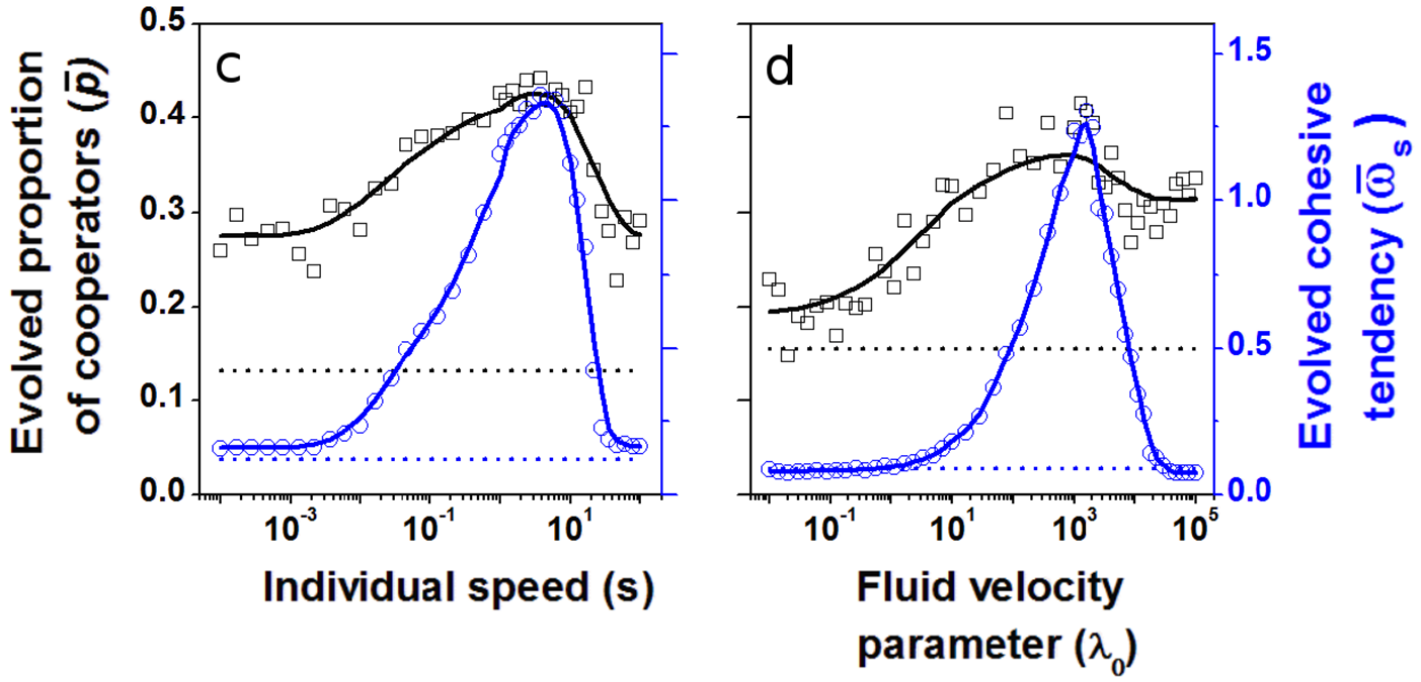


Evolution of proportion Cooperators



Comparison

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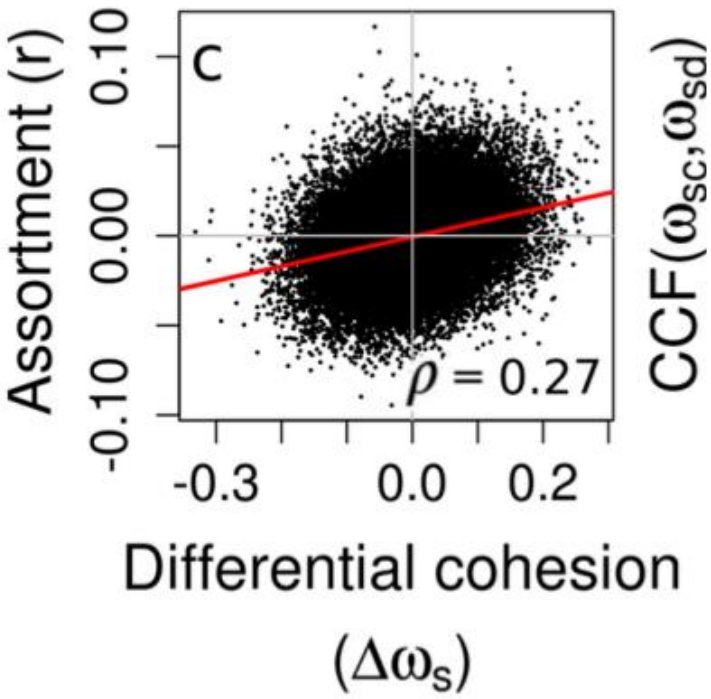
c
Assortment (r)
0.10
0.00
-0.10
-0.3
0.0
0.2
$\rho = 0.27$
$CCF(\omega_{sc}, \omega_{sd})$
Differential cohesion
$(\Delta\omega_s)$

Evolutionary Cycle

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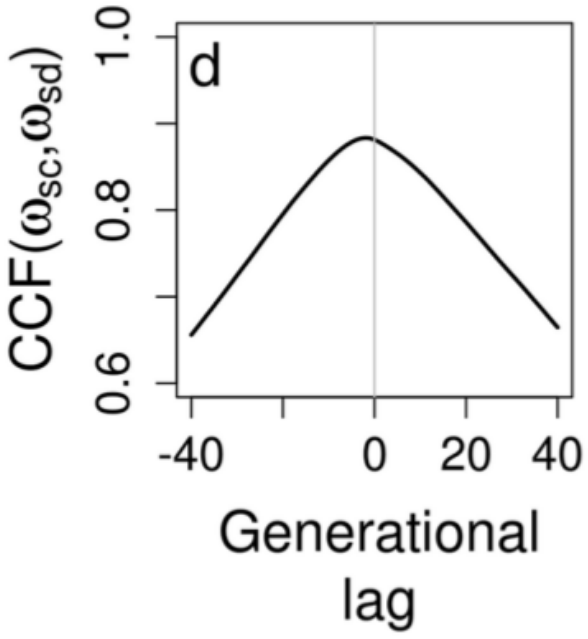

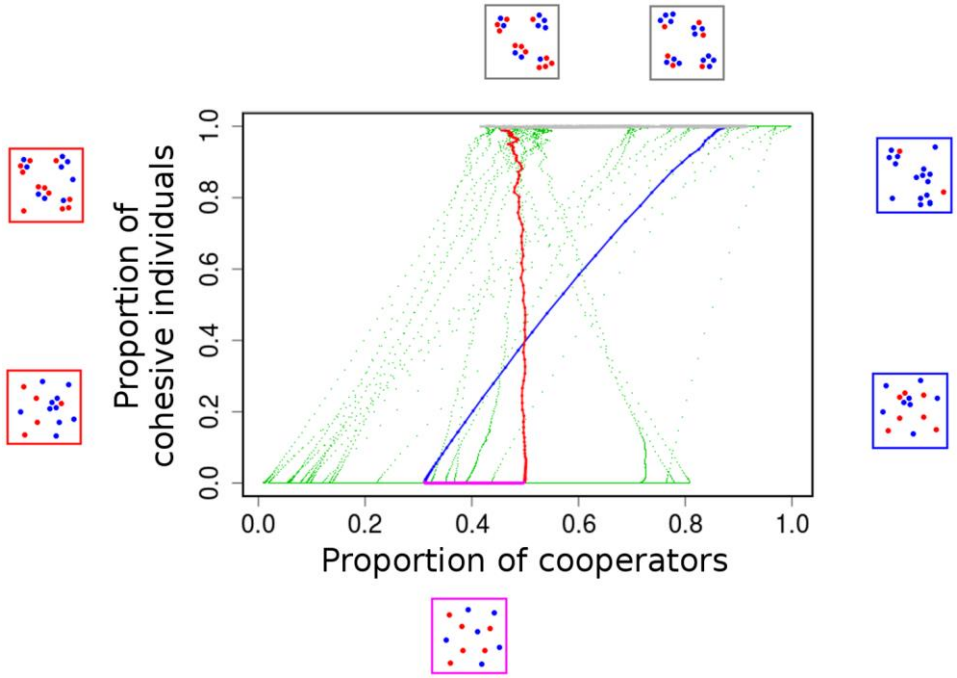

Amor et al., 2017

PLOS | COMPUTATIONAL BIOLOGY

RESEARCH ARTICLE

Spatial dynamics of synthetic microbial mutualists and their parasites

Daniel R. Amor[1,2,3], Raúl Montañez[2,3,4], Salva Duran-Nebreda[2,3], Ricard Solé[2,3,5]*

1 Physics of Living Systems, Department of Physics, Massachusetts Institute of Technology, Cambridge, Massachusetts, United States of America, **2** ICREA-Complex Systems Lab, Department of Experimental and Health Sciences, Universitat Pompeu Fabra, Barcelona, Spain, **3** Institute of Evolutionary Biology (CSIC-Universitat Pompeu Fabra), Barcelona, Spain, **4** Centre for Biomedical Network Research on Rare Diseases (ISCIII), Málaga, Spain, **5** Santa Fe Institute, Santa Fe, New Mexico, United States of America

* ricard.sole@upf.edu

Synthetic Hypercycle

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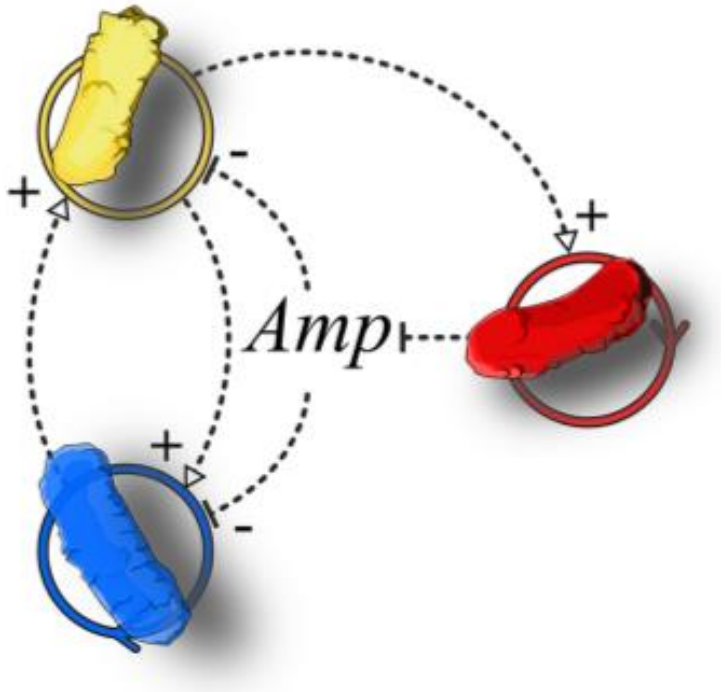

Synthetic Hypercycle

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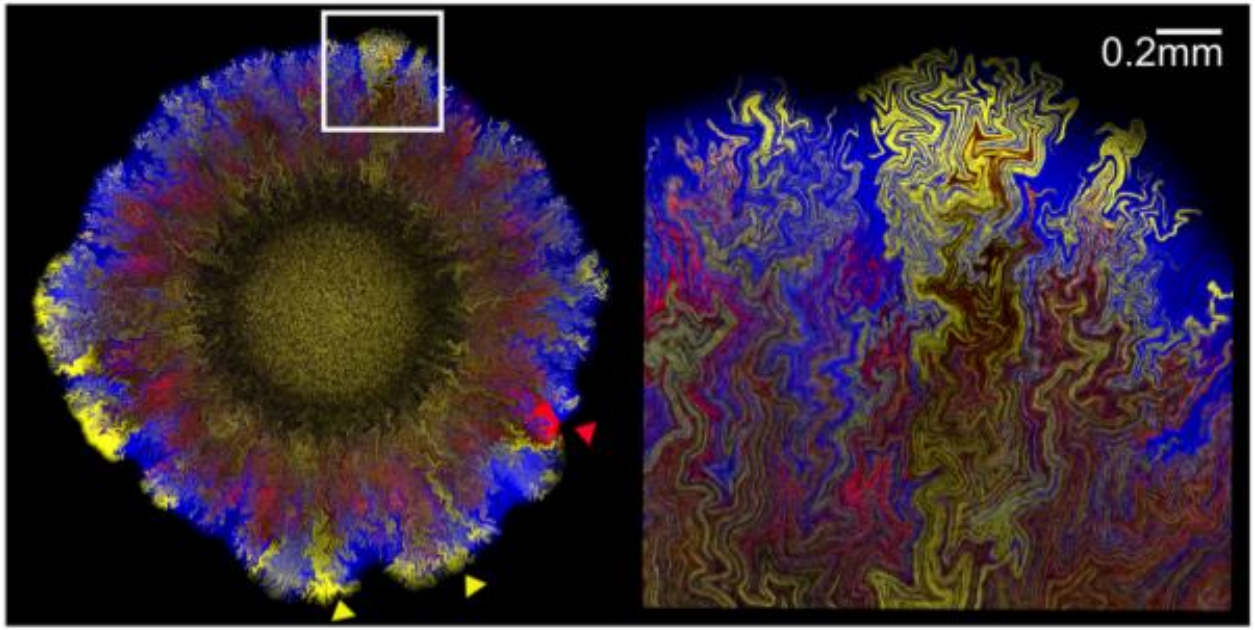

Synthetic Hypercycle

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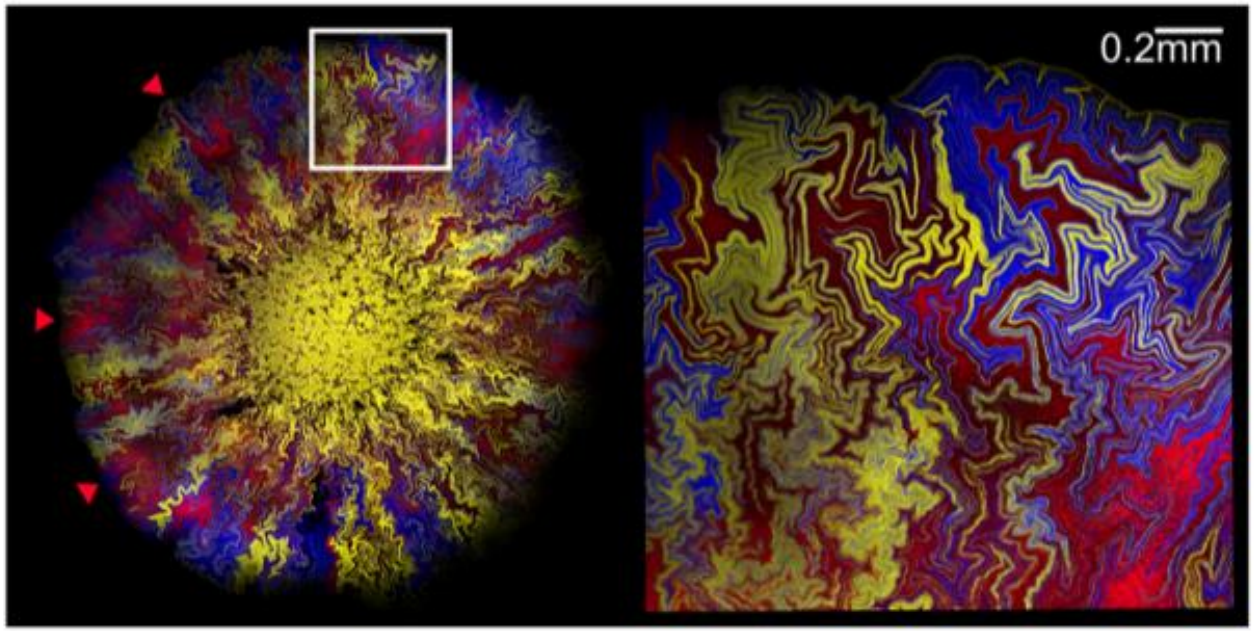

Agent-based Model

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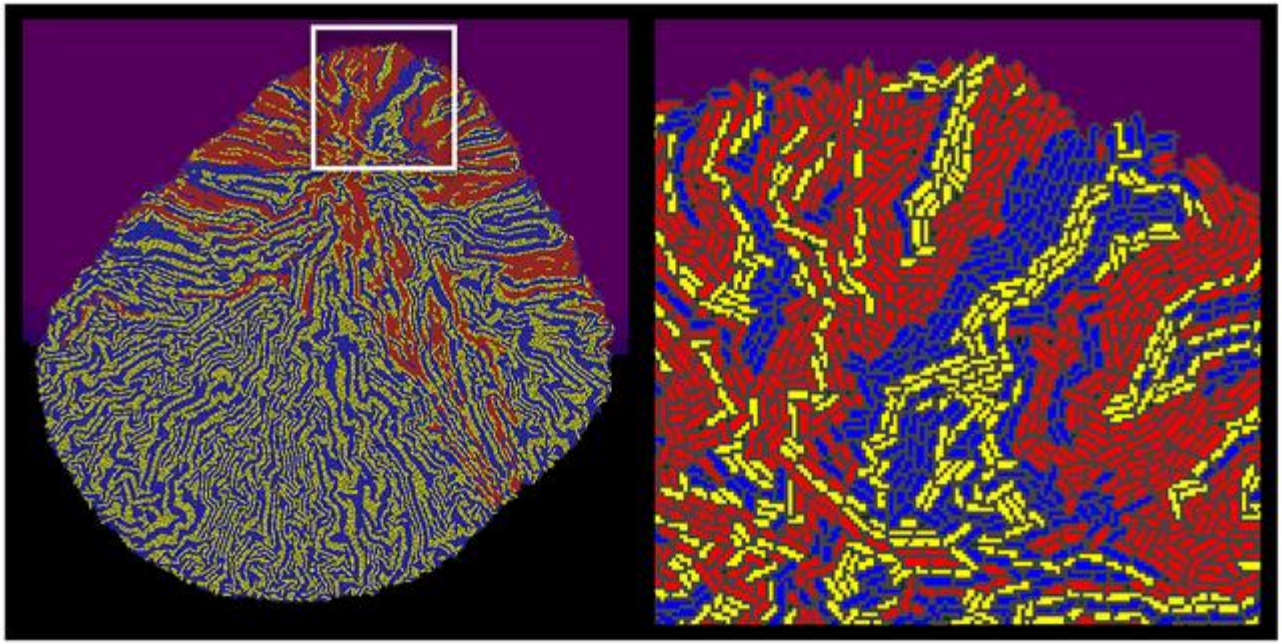
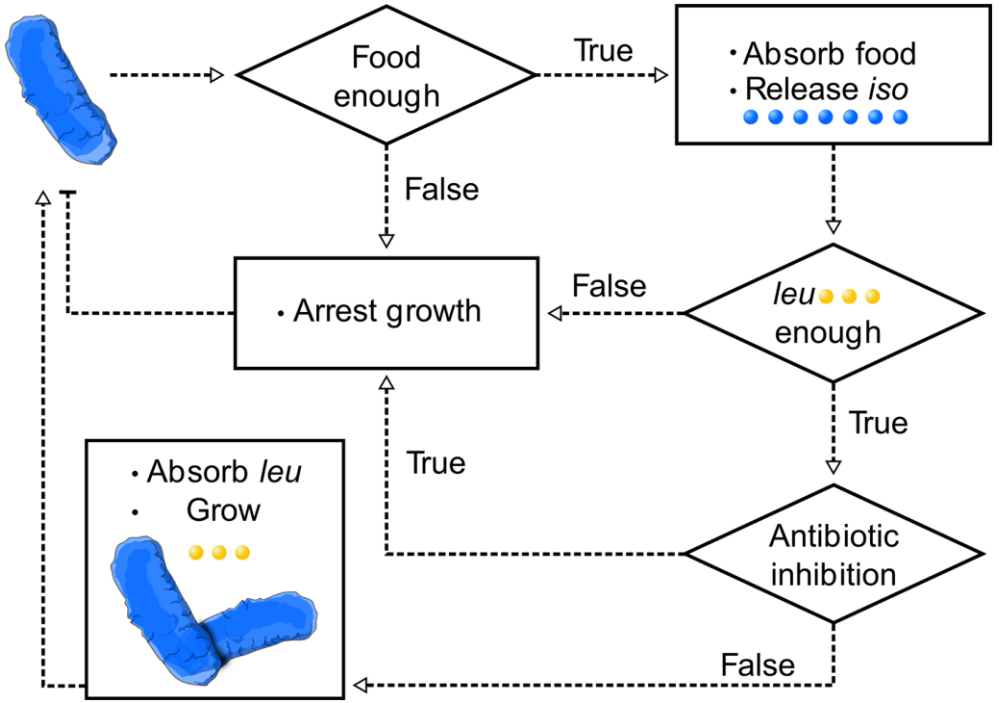


Comparisons



Comparisons

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Discussion

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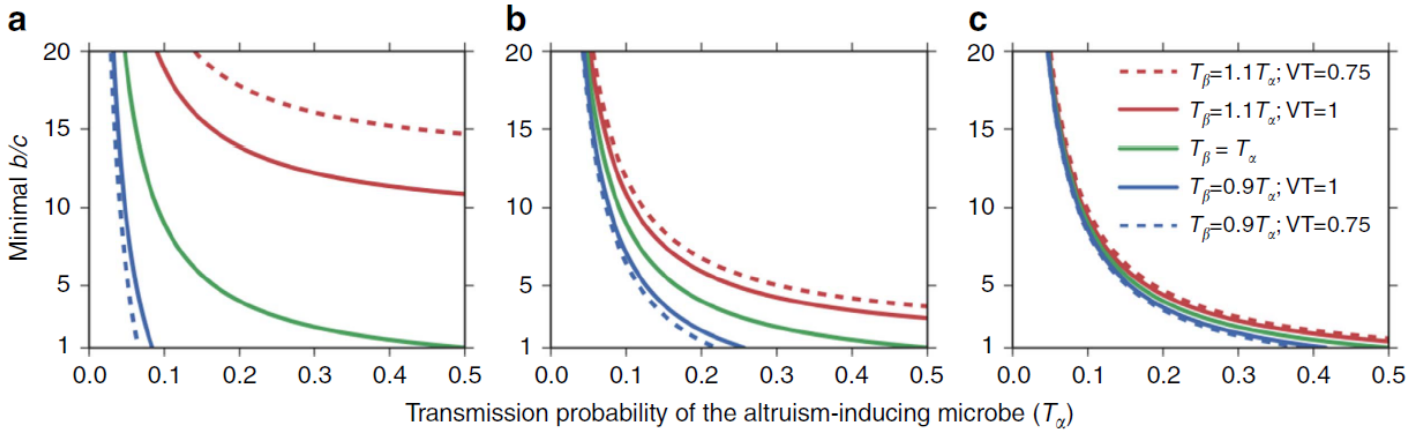
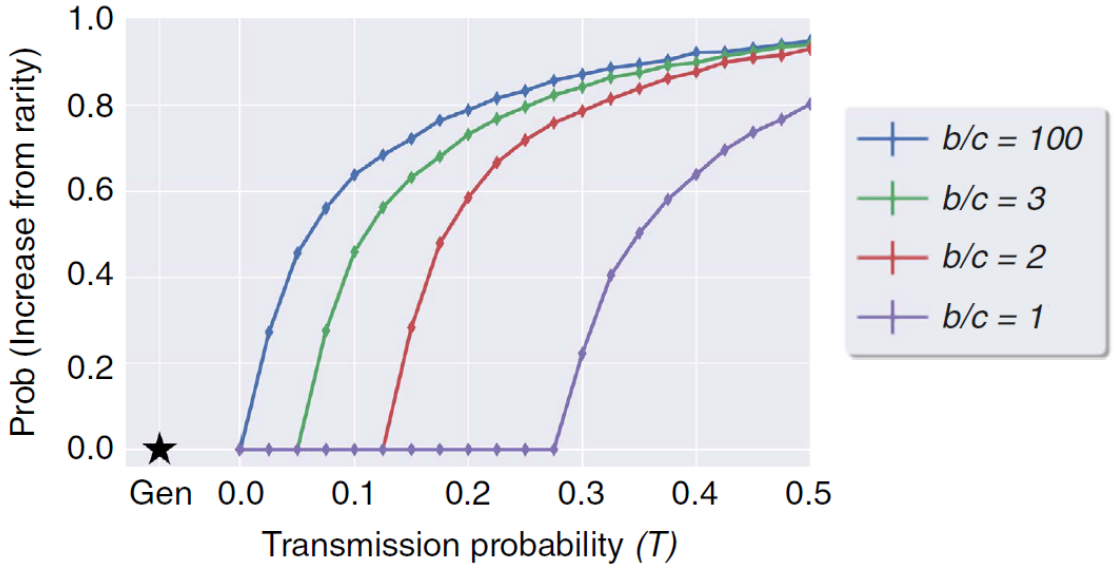
Take home message

Questions?

Bibliography

Lewin-Epstein extra results





Joshi extra results