SALVA **DURAN-NEBREDA**

PERSONAL & CONTACT INFORMATION

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on the web

RESEARCH INTERESTS

Complex Systems · Synthetic Biology · Artificial Life · Major Transitions in Evolution

Artificial Intelligence & Consciousness · Game Theory · Collective Behavior · Gerontology

EDUCATION

2010 – 2016 **Pompeu Fabra University, Spain**

PhD in Biomedicine

Qualification: *cum laude* · Department of Experimental and Health Sciences (CEXS)
Thesis: *Artificial multicellularity and pattern formation*
Obtained my PhD thesis on pattern formation and the emergence of multicellular systems by using experimental and theoretical / computational approaches in the Complex Systems Lab.
Advisor: Ricard V. Solé

2009 – 2010 **Autonomous University of Barcelona, Spain**

Masters degree in Biochemistry, Molecular Biology & Biomedicine

GPA: *8.0* · School of Biological Sciences & Postgraduate Studies
Thesis: *Lambda Phage Lytic-Lysogenic Switch: bistability in regulatory gene networks*
Studied the genetic network behind the life cycle of the lambda phage using different models and strategies: sets of coupled ordinary differential equations, hybrid stochastic-deterministic models and local stability analysis.
Advisors: Javier Macía & Ricard V. Solé

2005 – 2009 **Autonomous University of Barcelona, Spain**

Bachelor degree in Biotechnology

GPA: *7.5* · School of Biological Sciences
Wet-lab oriented degree focused on organism manipulation and usage in different scales. From lab techniques for cloning and recombinant gene expression in bacteria to bio-reactor design and protein purification. Besides bacteria, a great deal of the materials were about eukaryotic systems: transgenics, gene therapy and human pathologies.

WORK EXPERIENCE

2017 – 2019 **Research Fellow, University of Birmingham**

Bassel's Lab

Working on the evolution of multicellular complexity in the plant kingdom, using state of the art imaging techniques as well as graph theory metrics and modeling approaches to plant connectomes. Funding by Leverhulme Trust Grant RPG-2016-049.
Group Leader: George Bassel +44 (0) 121 41 42502 · g.w.bassel@bham.ac.uk

2016 – 2017 **Postdoctoral Researcher, Pompeu Fabra University**

ICREA-Complex Systems Lab

SYNCOM ERC project addresses how to implement distributed computation in synthetic cellular consortia, pushing the frontiers of computation in both engineered single-celled organisms and artificial ensembles by tackling the so called 'wiring problem'.
Group Leader: Ricard V. Solé +34 (93) 316 05 30 · ricard.sole@upf.edu

2016 – 2018 **Vice President of Moirai BioDesign**

Co-Founder of Moirai BioDesign

Created in May 2016, Moirai intends to design and bring to the market new diagnostic and therapeutic tools based on RNA and Synthetic Biology technologies. Selected by the SynBio accelerator program INDIEBIO in the 2016 startup round.
Contact at · salvador.duran@moiraibiodesign.com

2010 – 2016 **Predoctoral Researcher, Pompeu Fabra University**

ICREA-Complex Systems Lab

Received extensive training in non-linear systems, cellular automata, agent-based programming, stability analysis and deterministic and stochastic modeling while pursuing a PhD on pattern formation in biological systems (Turing instabilities, lateral inhibition and DLAs).
Group Leader: Ricard V. Solé +34 (93) 316 05 30 · ricard.sole@upf.edu

PEER-REVIEWED PUBLICATIONS

†= *These authors equally contributed to the article.*

= *Corresponding author.*

IF = *Journal Impact Factor, retrieved from Thomson Reuters Web of Science.*

2019

Duran-Nebreda S. and Bassel GW.# *Quantitative analysis of plant organ design using a 3D Digital Tissue Atlas of Arabidopsis thaliana* **Submitted to Cell Systems**.

Solé R.#, Fontich E., Duran-Nebreda S., Montañez R., Piñero J., and Valverde S. *The paradox of low oceanic plastic debris: evidence for evolved microbial biodegradation?* **Submitted to JRS Open Science**.

Duran-Nebreda S.# and Bassel GW#. *Biological computation in plants: distributed information processing in the solid state.* **Phil Trans Royal Soc B** (IF 5,67- Q1). April 2019, DOI: 10.1098/rsif.2017.0484.

Jackson MDB., Duran-Nebreda S., Kierzkowski D., Strauss S., Xu H., Landrein B., Hamant O., Smith RS., Johnston I. and Bassel GW.# *Global topological order emerges through local mechanical control of cell divisions in the Arabidopsis shoot apical meristem* **Cell Systems** (IF 8,99 - Q1). January 2019, DOI: 10.1016/j.cels.2018.12.009.

2018

Sánchez-Montesino R., Bouza-Morcillo L., Marquez J., Ghita M., Duran-Nebreda S., Stamm P., Gómez L., Holdsworth MJ., Bassel GW. and Oñate-Sánchez L.# *NAC transcription factors promote GA-mediated endosperm cell expansion and germination control in Arabidopsis seeds*. **Molecular Plant** (IF 9,33 - Q1). December 2018, DOI: 10.1016/j.molp.2018.10.009.

Solé R.#, Montañez R., Duran-Nebreda S., R. Amor D., Vidiella B. and Sardanyés J. *Population dynamics of synthetic Terraformation motifs*. **JRS Open Science** (IF 2,24 - Q2). January 2018, DOI: 10.1098/rsif.2017.0484.

Duran-Nebreda S. and Bassel GW.# *Fluorescein transport assay to assess bulk flow of molecules through the hypocotyl in* Arabidopsis thaliana. **Bioprotocols**. February 2018.

Solé R.#, Ollé-Vila A., Vidiella B., Duran-Nebreda S. and Conde-Pueyo N. *The road to synthetic multicellularity*. **Current Opinion in Systems Biology** (IF - Undetermined). January 2018, DOI: 10.1016/j.coisb.2017.11.007.

2017

Duran-Nebreda S. and Bassel GW.# *Bridging the scales in plant biology using network science*. **Trends in Plant Science** (IF 11,91 - Q1). October 2017, DOI: 10.1016/j.tplants.2017.09.017.

Carrignon S.#†, Ollé-Vila A.#†, Duran-Nebreda S.#†and Adams J.N. *Modeling the Coevolutionary Dynamics in the Lobaria pulmonaria Lichen Symbiosis* (Santa Fe Summer School project).

Jackson MDB., Duran-Nebreda S. and Bassel GW.# *Network-based approaches to quantify developmental processes*. **JRS Interface** (IF 3,82 - Q1). October 2017, DOI: 10.1098/rsif.2017.0484.

R. Amor D., Montañez R., Duran-Nebreda S. and Solé R.# *Spatial dynamics of synthetic microbial mutualists and their parasites*. **PLoS Computational Biology** (IF 4,59 - Q1). August 2017, DOI: 10.1371/journal.pcbi.1005689.

Jackson MDB., Xu H., Duran-Nebreda S., Stamm P., and Bassel GW.# *Topological analysis of multicellular complexity in the plant hypocotyl*. **eLife** (IF 7,73 - Q1) 6:e26023. July 2017, DOI: 10.7554/eLife.26023.

2016

Bonforti A.†, Duran-Nebreda S.†, Montañez R. and Solé R.# *Spatial self-organisation in hybrid models of multicellular adhesion*. **Chaos** (IF 1,76 - Q2) 26, 103113 (2016), DOI: 10.1063/1.4965992.

Duran-Nebreda S.†, Bonforti A.†, Montañez R.†, Valverde S. and Solé R.# *Emergence of proto-organisms from bistable stochastic differentiation and adhesion*. **JRS Interface** (IF 3,86 - Q1). April 2016, DOI: 10.1098/rsif.2016.0108.

Ollé-Vila A.†, Duran-Nebreda S.†, Conde-Pueyo N.†, Montañez R. and Solé R.# *Design principles for synthetic organs and organoids: the possible and the actual.* **Integrative Biology** (IF 3,76 - Q1). April 2016, DOI: 10.1039/C5IB00324E.

Duran-Nebreda S. and Solé R.# *Toward synthetic spatial patterns in engineered cell populations with chemotaxis.* **ACS Syn Bio** (IF 3,95 - Q1). April 2016, DOI: 10.10.1021/acssynbio.5b00254.

Solé R.#, Carbonell M., Duran-Nebreda S., R. Amor D., and Montañez R. *Synthetic collective intelligence.* **Biosystems** (IF 1,47 - Q2). February 2016, DOI: 10.1016/j.biosystems.2016.01.002.

2015

Solé R.#, Montañez R. and Duran-Nebreda S. *Synthetic Circuit Designs for Earth Terraformation.* **BMC Biology Direct** (IF 4,67 - Q1). July 2015, 10:37. *DOI: 10.1186/s13062-015-0064-7*.

Duran-Nebreda S. and Solé R.# *Emergence of multicellularity in a computational model of cell growth, death and aggregation under size-dependent selection.* **JRS Interface** (IF 3,92 - Q1). January 2015, DOI: 10.1098/rsif.2014.0982.

2014 Carbonell M.†, Duran-Nebreda S.†, Montañez R., Solé R., Macía J.# and Rodríguez-Caso C.# *A bottom-up characterisation of transfer functions for synthetic biology designs: lessons from enzymology.* **Nucleic Acids Research** (IF 9,11 - Q1). November 2014, DOI: 10.1093/nar/gku964.

BOOK CHAPTERS & SCIENCE OUTREACH PUBLICATIONS

2016 Duran-Nebreda S., Montañez R. Bonforti A., and Solé R. *The paths to artificial multicellularity: from physics to evolution.* KJ. Niklas and SA. Newman (eds.), *Multicellularity: Origins and Evolution*. **MIT Press, Massachussets**. February 2016, 149-168.

Solé R., Montañez R. and Duran-Nebreda S. *Hacia una bioingeniería del planeta.* **Investigación y Ciencia**. June 2016. Published in the spanish version of Scientific American.

2015 Solé R. and Duran-Nebreda S. *In silico transitions to multicellularity*. AM. Nedelcu and I. Ruiz-Trillo (eds.) *Evolutionary Transitions to Multicellular Life: Principles and Mechanisms*. **Springer-Verlag, London**. April 2015, 576, 342-348. Available through *ArXiv*.

2011 Duran-Nebreda S. *Cinco preguntas sobre Biología Sintética.* **Encuentros en la biología**. February 2011, issue 136, 67-68. Popular science magazine of the UoM, manuscript in spanish here.

TEACHING & MENTORING

2015–2016 Secondary PI, Pompeu Fabra University

iGEM - BCN Mentored a team of undergraduates who compete in the international Genetic Engineered Machines competition, performing an advisory role (PI) in the development of theoretical/computational models and synthetic biology wet-lab.

2012–2013 Assistant Teacher, Pompeu Fabra University

Mathematical Biomodeling **Degree in Biomedical Engineering** · 16 hours of programming sessions about classic models in biology: ecological interactions, epidemiology, fractals, tumour growth and immune systems.

Evolutionary Algorithms **Degree in Biomedical Engineering** · 16 hours of programming sessions about non-selection paradigms, search spaces and genotype-phenotype mapping in evolutionary algorithms.

Cell and Tissue Engineering **Degree in Biomedical Engineering** · 15 hours of wet-lab about standard synthetic biology procedures: cloning, screening, transfer functions and data fitting with hill functions.

COURSES, CONFERENCES & RESEARCH STAYS

March 2019 Conference · CompleNet poster presentation on organ design and complexity quantification through network theory in *A. thaliana* (Tarragona, ES).

July 2018 Conference · Society of Experimental Biology with accepted talk at the satellite *Systems analyses of multicellularity complexity and organ biology* (Florence, IT).

March 2018 Conference · Computation by natural systems (Milton Keynes, UK).

Summer 2016 Course · Santa Fe Summer School (New Mexico, USA).

December 2014 Research Stay · Santa Fe Institute (New Mexico, USA).

July 2013 Conference · Synthetic Biology 6.0 (Imperial College, UK).
Poster presentation PA-031: *Lessons from enzymology: How do ribosome binding sites effect affinity and basal expression in inducible genetic devices?* Carbonell M., Duran-Nebreda S., Macía J. and Rodríguez-Caso C.

June 2013 Course · Computer Optimized Microscopy (University of Barcelona, ES).

October 2012 Conference · Institute of Evolutionary Biology Retreat at IEC (Barcelona, ES)
Poster presentation: *Emergence of multicelullarity in a computational model of cell growth, death and aggregation under size-dependent selection.* Duran-Nebreda S. and Solé R.

Spring 2012 Research Stay · Santa Fe Institute (New Mexico, USA).

July 2011 Course · Systems Microscopy (University of Málaga, ES).

AWARDS & FELLOWSHIPS

2010 · Spanish Ministry of Science doctoral fellowship (MICINN-FPI BES-2010-038940)

2004 · Wet lab introduction for the best science students (ITU) – University of Barcelona

2004 · Excellent students of Catalonia – Caixa Manresa (Financial Institution)

OTHER INFORMATION

Languages

Spanish & Catalan · Mothertongue

English · FCE (2003), CAE (2007)

Journal Referee

PNAS · PLoS ONE · Phil. Trans. Royal Society B · Journal Royal Society Interface

Other Interests

Robots · 3D Printing & DIY · Game design · History · Astronomy & Space

July 25, 2019