

# SALVA DURAN-NEBREDA

## PERSONAL & CONTACT INFORMATION

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research webpage <https://www.salvadurannebreda.com>

other resources  ·  ·  ·  ·  · 

## RESEARCH INTERESTS

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

Networks · Cultural Evolution · Ecology · 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

2020 – 2023 Postdoctoral Researcher, CSIC

Evolution of  
Networks Lab

Funded by a **Beatriu de Pinós** Grant, I am carrying a project about ecological hypergraph assembly and resilience. Working with plant species interaction datasets annotated with environmental and biome information I seek to address pressing questions about climate change and ecological robustness using hypergraph theory and macroevolutionary models.

Group Leader: SERGI VALVERDE CASTILLO +34 (0) 121 41 42502 · [sergi.valverde@ibe.upf-csic.es](mailto:sergi.valverde@ibe.upf-csic.es)

2017 – 2019 Research Fellow, University of Birmingham

Bassel's Lab

Worked on the evolution of multicellular complexity in the plant kingdom, using synthetic biology, state of the art imaging techniques and graph theory metrics and modeling approaches to understand **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](mailto:g.w.bassel@bham.ac.uk)

2016 – 2020 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. Since January of 2020 and in order to avoid academic and fellowship incompatibilities, I am no longer involved with Moirai, as VP, board member or shareholder.

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](mailto:ricard.sole@upf.edu)

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](mailto:ricard.sole@upf.edu)

2009 – 2010      Internship, Autonomous University of Barcelona

Neurobiology  
Group

Studied the differentiation process in primary cultures of neurons. Expressed some master regulators and quantified the phenotypical variations in axon length using ImageJ scripts.  
Group Leader: JOSÉ RODRÍGUEZ ÁLVAREZ · [jose.rodriquez@uab.es](mailto:jose.rodriquez@uab.es)

2008 – 2009      Internship, Autonomous University of Barcelona

Molecular  
Genetics Group

Cloned, expressed and purified mobility proteins of *M. genitalium* related to pathogenicity. Immunized mice and generated specific monoclonal antibodies for diagnostic use.  
Group Leader: JAUME PINYOL · [jaume.pinyol@uab.es](mailto:jaume.pinyol@uab.es)

### PEER-REVIEWED PUBLICATIONS

† = These authors equally contributed to the article.

# = Corresponding author.

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

- 2023      DURAN-NEBREDAS., JACKSON MDB., AND BASSEL GW.# *Quantitative analysis of plant organ design using a 3D Digital Tissue Atlas of Arabidopsis thaliana* **Current Biology** (IF 10,9 - Q1 ) November 2023.
- O'BRIEN MJ.#, VALVERDE] S., DURAN-NEBREDAS., VIDIELLA B. AND BENTLEY RA. *Punctuated equilibrium at 50: Anything there for evolutionary anthropology? Yes; definitely* **Evolutionary Anthropology** (IF 6,1 - Q1 ) November 2023.
- BENTLEY RA.#, VALVERDE] S., BORYCZ J., VIDIELLA B, HORNE BD., DURAN-NEBREDAS. AND O'BRIEN MJ. *Is disruption decreasing, or is it accelerating?* **Advances in Complex Systems** (IF 1,26 - Q3 ) June 2023.
- DURAN-NEBREDAS.#, AND VALVERDE S.# *Composition, structure and robustness of Lichen guilds* **Scientific Reports** (IF 4,6 - Q1 ) February 2023.
- 2022      DURAN-NEBREDAS.#, O'BRIEN M., BENTLEY A. AND VALVERDE S.# *Dilution of expertise in the rise and fall of collective innovation* **Nature Humanities and social sciences** (IF 2,73 - Q1 ) October 2022.
- 2021      DURAN-NEBREDAS.# et al. *Synthetic lateral inhibition in engineered microbial colonies* **ACS Synthetic Biology** (IF 5,57 - Q1 ) January 2021.
- 2020      WOLNY Adrian, et al. *Accurate and versatile 3D segmentation of plant tissues at cellular resolution* **eLife** (IF 7,08 - Q1 ). July 2020, 9:e57613 DOI: [10.7554/eLife.57613](https://doi.org/10.7554/eLife.57613).
- DURAN-NEBREDAS., JOHNSTON IG. AND BASSEL GW.# *Efficient vasculature investment in tissues can be determined without global information* **JRS Interface** (IF 3,86 - Q1). April 2020, DOI: [10.1098/rsif.2020.0137](https://doi.org/10.1098/rsif.2020.0137).
- 2019      DURAN-NEBREDAS.# AND BASSEL GW#. *Plant behaviour in response to the environment: information processing in the solid state..* **Phil Trans Royal Soc B** (IF 5,67- Q1). April 2019, DOI: [10.1098/rsif.2017.0484](https://doi.org/10.1098/rsif.2017.0484).
- JACKSON MDB., DURAN-NEBREDAS., 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](https://doi.org/10.1016/j.cels.2018.12.009).
- SÁNCHEZ-MONTESINO R., BOUZA-MORCILLO L., MARQUEZ J., GHITA M., DURAN-NEBREDAS., STAMM P., GÓMEZ L., HOLDSWORTH MJ., BASSEL GW. AND OÑATE-SÁNCHEZ L.# *A regulatory module controlling GA-mediated endosperm cell expansion is critical for seed germination in Arabidopsis.* **Molecular Plant** (IF 9,33 - Q1). December 2018, DOI: [10.1016/j.molp.2018.10.009](https://doi.org/10.1016/j.molp.2018.10.009).
- 2018      SOLÉ R.#, MONTAÑEZ R., DURAN-NEBREDAS., R. AMOR D., VIDIELLA B. AND SARDANYÉS J.

- Population dynamics of synthetic Terraformation motifs. **JRS Open Science** (IF 1,13 - Q1). January 2018, DOI: [10.1098/rsif.2017.0484](https://doi.org/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 2,09 - Q1). January 2018, DOI: [10.1016/j.coisb.2017.11.007](https://doi.org/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](https://doi.org/10.1016/j.tplants.2017.09.017).
- CARRIGNON S.#, OLLÉ-VILA A.#, DURAN-NEBREDA S. AND ADAMS J.N. *Modeling the Co-evolutionary 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](https://doi.org/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](https://doi.org/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](https://doi.org/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](https://doi.org/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](https://doi.org/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](https://doi.org/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: [10.1021/acssynbio.5b00254](https://doi.org/10.1021/acssynbio.5b00254).
- SOLÉ R.#, CARBONELL M., DURAN-NEBREDA S., R. AMOR D., and MONTAÑEZ R. Synthetic collective intelligence. **Biosystems** (IF 0,57 - Q2). February 2016, DOI: [10.1016/j.biosystems.2016.01.002](https://doi.org/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](https://doi.org/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](https://doi.org/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](https://doi.org/10.1093/nar/gku964).

#### BOOK CHAPTERS & SCIENCE OUTREACH PUBLICATIONS

- 2023 DURAN-NEBREDA S., VALVERDE S. *The Natural Evolution of Computing*. R. Kendal, J. Tehrani and J. Kendal (eds.), **Oxford Handbook of Cultural Evolution**. Oxford University Press, Oxford. 2023.
- 2022 DURAN-NEBREDA S., VALVERDE S. *Rashevsky's dream: A physico-mathematical foundation of history and culture*. **Metode**. **Metode Science Studies Journal**. July 2022. DOI: [10.7203/metode.13.21763](https://doi.org/10.7203/metode.13.21763).
- 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, Massachusetts. 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

## TEACHING & MENTORING

	2024	Master's thesis, Pompeu Fabra University
UPF-CSIC		Currently mentoring an international student in their master's thesis. This project expanded on prior work I did on Lichen guilds, with the student being trained in network analysis to carry out similar research on coral ecological networks.
	2021	TFG Mentor, Pompeu Fabra University
UPF-CSIC		Mentored in official capacity a student during their end of degree thesis (TFG). The thesis studied cultural evolution in speedrunning communities, modeling population growth and network evolutionary dynamics.
	2015–2016	Secondary PI, Pompeu Fabra University
iGEM-UPF		Mentored a team of undergraduates who compete in the <a href="#">international Genetic Engineered Machines competition</a> , performing an advisory role (PI) in the development of theoretical/computational models and synthetic biology wet-lab.
	2012–2013	Teaching Assistant, Pompeu Fabra University
Mathematical Biomodeling		<a href="#">Degree in Biomedical Engineering</a> · 16 hours of programming sessions about classic models in biology: ecological interactions, epidemiology, fractals, tumour growth and immune systems.
Evolutionary Algorithms		<a href="#">Degree in Biomedical Engineering</a> · 16 hours of programming sessions about non-selection paradigms, search spaces and genotype-phenotype mapping in evolutionary algorithms.
Cell and Tissue Engineering		<a href="#">Degree in Biomedical Engineering</a> · 15 hours of wet-lab about standard synthetic biology procedures: cloning, screening, transfer functions and data fitting with hill functions.

## COURSES, CONFERENCES & RESEARCH STAYS

July 2023	CONFERENCE · <a href="#">NetSci 2023</a> Accepted talk: <i>The structure of the global network of Lichen Symbionts</i> (Vienna, AT).
March 2021	CONFERENCE · <a href="#">Synthetic Morphogenesis</a> Poster on synthetic pattern formation (Online).
March 2019	CONFERENCE · <a href="#">CompleNet</a> poster presentation on organ design and complexity quantification through network theory in <i>A. thaliana</i> (Tarragona, ES).
July 2018	CONFERENCE · <a href="#">Society of Experimental Biology</a> with accepted talk at the satellite <i>Systems analyses of multicellularity complexity and organ biology</i> (Florence, IT).
March 2018	CONFERENCE · <a href="#">Computation by natural systems</a> (Milton Keynes, UK).
Summer 2016	COURSE · <a href="#">Santa Fe Summer School</a> (New Mexico, USA).
December 2014	RESEARCH STAY · <a href="#">Santa Fe Institute</a> (New Mexico, USA).
July 2013	CONFERENCE · <a href="#">Synthetic Biology 6.o</a> . Poster presentation: <i>How do ribosome binding sites effect affinity and basal expression in inducible genetic devices?</i> (Imperial College, UK).
June 2013	COURSE · <a href="#">Computer Optimized Microscopy</a> (University of Barcelona, ES).
October 2012	CONFERENCE · <a href="#">Institute of Evolutionary Biology</a> Poster presentation: <i>Emergence of multicellularity in a computational model of cell growth, death and aggregation</i> (Barcelona, ES).
Spring 2012	RESEARCH STAY · <a href="#">Santa Fe Institute</a> (New Mexico, USA).
July 2011	COURSE · <a href="#">Systems Microscopy</a> (University of Málaga, ES).

## AWARDS & FUNDING

- 2021 - 2023 · AGAUR postdoctoral fellowship [Beatriu de Pinós](#). Awarded amount: 144.300€.
- 2019 · [SME1 grant](#) by the European Union to pay a lab technician's salary, me acting as principal investigator while at [Moirai Biodesign](#). Awarded amount: 71.429€.
- 2018 - 2020 · [Tecniospring Industry grant](#) by the Generalitat de Catalunya, to pay for a postdoctoral researcher (me acting as principal investigator while at [Moirai Biodesign](#)). Awarded amount: 137.160€
- 2010 - 2014 · Spanish Ministry of Science doctoral fellowship [MICINN-FPI BES-2010-038940](#). Awarded amount: 89.540€
- 2004 · Wet lab introduction for the best science students (ITU) – University of Barcelona

**OTHER INFORMATION**

<i>Languages</i>	SPANISH & CATALAN · Mother tongue ENGLISH · FCE (2003), CAE (2007)
<i>Journal Referee</i>	PNAS · PLoS ONE · PLoS Comp. Bio. · Phil. Trans. Royal Society B · Journal Royal Society Interface
<i>Journal Editor</i>	Symmetry · <a href="#">Frontiers in Plant Physiology</a>

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