JUAN DÍAZ-COLUNGA

Post-doctoral Researcher
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research statement

It has become increasingly clear that many complex behaviors of biological systems emerge from the interactions of their individual components and the states that result from their assembly into connected networks. This realization, together with the development of high throughput technologies, has forced a paradigm shift in biological research: today, biology is more quantitative and integrative than ever, which has generated a need for tools from physics, mathematics and computer science.

I became interested in systems biology early in my undergraduate years. As a physicist with a passion for mathematical modeling, computer simulation and data analysis, I went on to pursue a master's degree in biomedical engineering followed by a PhD in computational biology. During that time, I focused my work on the origins of cell-to-cell phenotypic differences and how they induce variable apoptotic responses. I used tools such as kinetic modeling and stochastic simulation, sequencing data processing and image analysis. Later, I moved to the field of ecology and evolution for a 6-month stay at the Gore lab at MIT. There I gained valuable wet lab experience while developing a project on the emergence of inducibility in *E. coli* promoters. I am currently a postdoc at the Universidad Autónoma in Madrid, where I keep working on evolution in the context of cancer heterogeneity.

I consider myself a curious and versatile researcher with broad interests. My aim is to combine theory and experiments that elucidate the mechanisms through which evolution generates novel behaviors and shapes the structure of cellular communities and their interactions with the environment.

education

PhD in Biophysics
Universidad Autónoma de Madrid, 2015-19

MSc in Biomedical Engineering
Universidad Politécnica de Madrid, 2013-14

Degree in Physics
Universidad Autónoma de Madrid, 2009-13

academic awards

PhD *cum laude*
2019

'Severo Ochoa' Excellence PhD Fellowship
2015-2019

Comunidad de Madrid Award for Excellent Undergraduate Students
2009-13

research experience

Post-doctoral Researcher
Universidad Autónoma de Madrid (UAM)
School of Medicine – department of Biochemistry
Madrid, Spain (2019-present)
Project: *Evolution of genetic heterogeneity in cancer: Cancer Progression Models*

Visiting Researcher
Massachusetts Institute of Technology (MIT)
Gore Lab for Ecological Systems Biology
Boston, US (2018)
Project: *Evolution of inducibility in* E. coli *promoters*

Pre-doctoral Researcher
Spanish National Center for Biotechnology (CNB)
Biological Noise lab
Madrid, Spain (2015-19)
Project: *Mitochondrial control of gene expression and extrinsic apoptosis*

publications

Márquez-Jurado S*, **Díaz-Colunga J***, das Neves RP, Martínez-Lorente A, Almazán F, Guantes R & Iborra FJ (2018). Mitochondrial levels determine variability in cell death by modulating apoptotic gene expression. *Nature Communications* **9**:389 (*equal contribution)

Lima AF, May G, **Díaz-Colunga J**, Pedreiro S, Paiva A, Ferreira L, Enver T, Iborra FJ & das Neves RP (2018). Osmotic modulation of chromatin impacts on efficiency and kinetics of cell fate modulation. *Scientific Reports* **8**:7210

Marcos-Villar L, **Díaz-Colunga J**, Sandoval J, Zamarreño N, Landeras-Bueno S, Esteller M, Falcón A & Nieto A (2018). Epigenetic control of influenza virus: role of H3K79 methylation in interferon-induced antiviral response. *Scientific Reports* **8**:1230

Guantes R, **Díaz-Colunga J** & Iborra FJ (2016). Mitochondria and the non-genetic origins of cell-to-cell variability: More is different. *BioEssays* **38**:64-76

talks

The energy cost of living and dying
MIT – Physics of Living Systems
Boston, US (2018)

Mitochondrial regulation of extrinsic apoptosis
European Molecular Biology Laboratory (EMBL)
Heidelberg, Germany (2017)

Can we predict apoptosis?
Spanish National Center for Biotechnology (CNB)
Madrid, Spain (2016)

complementary education

Lab safety trainings
MIT – Physics of Living Systems
Boston, US (2018)
&
Spanish National Center for Biotechnology (CNB)
Madrid, Spain (2015)

Statistics and R for the Life Sciences
HarvardX
Online course (2016)

RNA-seq data processing training
Spanish National Center for Genomic Analysis
Barcelona, Spain (2015)

meetings

Heterogeneity and Evolution in Cancer
Spanish National Cancer Research Center (CNIO)
Madrid, Spain (2019)

MIT Biophysics Retreat
MIT – Physics of Living Systems
Cape Cod, US (2018)

Quantitative Principles in Biology
European Molecular Biology Laboratory (EMBL)
Heidelberg, Germany (2017)
Poster presentation: *Mitochondrial levels determine variability in cell death by modulating apoptotic gene expression*

Canceromatics III – Tumor Heterogeneity
Spanish National Cancer Research Center (CNIO)
Madrid, Spain (2016)
Poster presentation: *Mitochondrial levels determine variability in apoptosis through global modulation of gene expression*

The Physics of Living Systems: from Biomolecular Nanomachines to Tissues and Organisms
'Nicolás Cabrera' Institute
Madrid, Spain (2016)
Poster presentation: *Mitochondria and the non-genetic origins of cell-to-cell variability*

XIX Young Researchers Meeting
'Nicolás Cabrera' Institute
Madrid, Spain (2016)
Poster presentation: *Cell-to-cell differences in mitochondrial content induce phenotypic variability*

skills

Computation & programming
R, Matlab, Julia, C++
Bioinformatics software (*TopHat*, *Cufflinks*, *Salmon*…) and R packages (*edgeR*, *DESeq2*…)
Windows & Linux environments
LaTeX, office & graphics software

Basic wet lab competences
Media preparation, bacterial culture and plating, etc.

Languages
English (fluent), Spanish (native), German (basic)

Team worker, comfortable in multidisciplinary teams
Synthesis & communication skills (oral & written)
Ease for autonomous learning & working