

## Curriculum Vitae

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### Research interests

I am a quantitative ecologist with a background in statistical physics. My research focuses on the study of complex biological systems, ranging from cell aggregates to entire ecosystems. Using a combination of physics and mathematical and computational tools, I develop simple, yet biologically-grounded models that I then compare to empirical data. More specifically, I am interested in quantifying the interactions that occur within complex biological systems; how they are shaped by the effect of the environment and how they impact the emergence of patterns at larger scales.

Copies of my publications can be accessed via my personal webpage <http://www.princeton.edu/~ricardom/>, and a bibliometric summary of my work can be obtained from my Google Scholar profile <https://scholar.google.com/citations?user=tak0qSUAAA&hl=en>

### Research Appointments

- 2016-** Life Sciences Research Foundation Postdoctoral Fellow. Department of Ecology and Evolutionary Biology, Princeton University, USA.
- 2014-16** Postdoctoral Research Associate. Department of Ecology and Evolutionary Biology, Princeton University.
- 2010-14** CSIC JAE-Predoc Fellow. Institute for Cross Disciplinary Physics and Complex Systems (IFISC), Palma de Mallorca, Spain.

### Education

- PhD 2014** Physics. Institute for Cross-Disciplinary Physics and Complex Systems (IFISC). June 2014.
- MSc 2011** Physics. University of the Balearic Islands. September 2011.
- BSc 2010** Physics. University of La Laguna. Specialization in Theoretical Physics.

### Awards & Honors

- 2017** PLoS Early Career Travel Award.
- 2015** Honorific Mention of the Spanish National Research Council (CSIC) for research achievements during the academic year 2014/2015.
- 2014** Montserrat Casas award in the category of Sciences, Engineering and Architecture. Best PhD research in the Balearic Islands, Spain.
- 2013** Banco Santander-UIB award. Best PhD students in the University of the Balearic Islands.
- 2006** Bronze Medal, Spanish Physics Olympiad.

## Fellowships

- 2017 Visiting scholar fellowship from the University of the Balearic Islands.
- 2016 Life Sciences Research Foundation. Gordon and Betty Moore Postdoctoral Fellowship.
- 2016 US National Science Foundation (NSF) Travel Grant.
- 2015 Visiting scholar fellowship from the University of the Balearic Islands.
- 2010 JAE-Predoc Graduate Fellowship. Spanish Research Council (2010-2014; Master + PhD).
- 2009 Undergraduate collaboration student. Spanish Ministry of Education of Science
- 2009 JAE-Intro Undergraduate Fellowship. Spanish Research Council.

## Publications

### Peer reviewed journals.

- 13 **R. Martínez-García** and C.E. Tarnita. *Seasonality can induce coexistence of multiple bet-hedging strategies in Dictyostelium discoideum.* J Theor Biol, 426, 104-116 (2017).
- 12 **R. Martínez-García**, J.M. Calabrese and C. López. *Online games: a novel approach to explore how partial information influences human random searches.* Scientific Reports, 7, 40029 (2017).
- 11 **R. Martínez-García** and C.E. Tarnita, *Lack of Ecological and Life History Context Can Create the Illusion of Social Interactions in Dictyostelium discoideum.* PLoS Comp Biol 12(12): e1005246 (2016).
- 10 **R. Martínez-García**, C. Murgui, E. Hernández-García and C. López. *Pattern formation in populations with density-dependent movement and two interaction scales.* PLoS ONE 10(7): e0132261 (2015).
- 9 **R. Martínez-García**, C. López and F. Vazquez. *Optimal recruitment strategies in groups of interacting walkers with leaders.* Phys Rev E, 91, 022117 (2015).
- 8 C.E. Tarnita\*, A. Washburne\*, **R. Martínez-García**, A.E. Sgro and S.A. Levin. *Fitness tradeoffs between spores and nonaggregating cells can explain the coexistence of diverse genotypes in cellular slime molds.* Proc. Natl. Acad. Sci. USA, 12(9), 2776-2781 (2015). (\*co-first authors)  
- Commentary by P.B. Rainey: *Precarious development: The uncertain social life of cellular slime molds,* Proc. Natl. Acad. Sci. USA, 112:2639-2640.
- 7 **R. Martínez-García**, J.M. Calabrese, E. Hernández-García, and C. López. *Minimal mechanisms for vegetation patterns in semiarid regions.* Philos. T. R. Soc. A, 372(2027): 20140068 (2014).
- 6 **R. Martínez-García**, J.M. Calabrese, and C. López. *Optimal search in interacting populations: Gaussian jumps versus Lévy flights.* Phys Rev E, 89, 032718, (2014).
- 5 **R. Martínez-García**, J.M. Calabrese, E. Hernández-García, and C. López. *Vegetation pattern formation in semiarid systems without facilitative mechanisms.* Geophys Res Lett, 40, 6143-6147, (2013).
- 4 **R. Martínez-García**, J.M. Calabrese and C. López. *Spatial patterns in mesic savannas: the local facilitation limit and the role of demographic stochasticity.* J Theor Biol, 333, 156-165, (2013).
- 3 **R. Martínez-García**, J.M. Calabrese, T. Mueller, K.A. Olson and C. López. *Optimizing the search for resources by sharing information: Mongolian gazelles as a case study.* Phys Rev Lett, 110, 248106, (2013).

- Selected as Editor's suggestion and highlighted by the American Physical Society (*Physics Focus*), *Physics World*, *The Hindu* (Indian general newspaper), the Spanish Royal Society of Physics and local press.

- 2 **R. Martínez-García**, F. Vázquez, C. López and M.A. Muñoz. *Temporal disorder in up-down symmetric systems*. *Phys Rev E*, 85, 051125, (2012).
- 1 S. Brouard and **R. Martínez**. *Cavity-mediated entanglement between distant atoms: Effect of spatial dispersion*. *Phys Lett A*. 375, 1640-1645, (2011).

#### In review / In preparation

- **R. Martínez-García**, C.D. Nadell, R. Hartmann, K. Drescher, J.A. Bonachela. *Cell adhesion and fluid flow jointly initiate biofilm genetic structure*. In review (available upon request).
- F. W. Rossine\*, **R. Martínez-García**\*, A.E. Sgro, T. Gregor, C.E. Tarnita. *Individuals out-of-sync could bring adaptive advantages to the rest of the population*. In preparation. \*co-first authors
- **R. Martínez-García**, C. López. *Mechanisms of pattern formation in arid ecosystems. From scale-dependent feedbacks to long-range competition alone*. Review article invited by the Catalan Society of Biology. In preparation.

#### Research projects

##### As Principal Investigator

- 2016- *Using Dictyostelium discoideum to understand the role of ecology and multiple fitness tradeoffs in the evolution of multicellularity*. Gordon Betty Moore Foundation, GBMF2550.06 (\$180.000). PI: **Ricardo Martínez-García**.

##### Participation

- 2016-18 *Lagrangian studies of Oceanic Processes: connectivity patterns, barriers to transport and marine population (LAOP)*. CTM2015-66407-P. P.I: Cristóbal López.
- 2013-14 *Complex Systems Physics: Information, Technology, Society and Ecology (INTENSE@COSYP)*. FIS2012-30634. P.I: Maxi San Miguel.
- 2010-13 *Física Interdisciplinar y Sistemas Complejos (FISICOS)*. FIS2007-60327. P.I: Maxi San Miguel.

#### Presentations

##### Invited seminars

- 2017 *Cruzando dos charcos: mi camino de la ULL a Princeton y de la física a la biología*. (In Spanish), Universidad de La Laguna, Faculty of Sciences, La Laguna, Spain.
- 2016 *Online games: a novel approach to explore how partial information influences random search processes*. IFISC Seminar, Palma de Mallorca, Spain.
- 2015 *The role of ecology in the evolution of multicellularity*. IFISC Seminar, Palma de Mallorca, Spain.
- 2014 *Nonequilibrium Statistical Physics in Ecology: animal mobility and temporal fluctuations*. IMEDEA Seminar, Esporles, Spain.
- 2014 *Optimizing the search for resources by sharing information: the Mongolian gazelle*. Institute for Chemistry and Biology of the Marine Environment. Carl von Ossietzky University. Oldenburg, Germany.
- 2014 *Vegetation patterns. The role of nonlocal interactions*. IFISC Seminar, Palma de Mallorca, Spain.

- 2013**     *Searching with communication: the case of the Mongolian gazelle.* IFISC Seminar, Palma de Mallorca, Spain.
- 2011**     *The effect of temporal disorder in complex systems.* Seminar of the Faculty of Physics of the University of La Laguna. La Laguna, Spain.

## Conference participation

### Invited presentations

- 2017**     *The role of life-history tradeoffs and environmental heterogeneity in Dictyostelium discoideum diversity.* Conference on ecology and evolutionary biology, deterministic and stochastic models. Toulouse, France. October 9-13.

### Contributed presentation

- 2017**     *Lack of ecological and life-history context can create the illusion of microbial social interactions.* Mathematical Models in Ecology and Evolution 2017. London, U.K., 10-12 July.
- 2017**     *Cell adhesion and fluid flow jointly initiate biofilm genetic structure.* Crossroads in the Complex Systems. Palma, Spain. 5-8 June.
- 2017**     *Lack of ecological and life-history context can create the illusion of social interactions.* Modelling Biological Evolution 2017. Leicester, U.K. 4-7 April.
- 2016**     *Lack of ecological and life history context may result in the illusion social success in Dictyostelium discoideum.* European Conference Mathematical Biology. Nottingham, U.K. July 10-15.
- 2016**     *Lack of ecological and life history context may result in the illusion social success in Dictyostelium discoideum.* Quantitative Laws II. Lake Como, Italy. June 13-24.
- 2015**     *Fitness tradeoffs between spores and nonaggregating cells can explain the coexistence of diverse genotypes in cellular slime molds.* Mathematical Models in Ecology and Evolution. Paris, France. July 7-10.
- 2015**     *Fitness tradeoffs between spores and nonaggregating cells can explain the coexistence of diverse genotypes in cellular slime molds.* 25<sup>th</sup> Granada Seminar. Granada, Spain. June 15-19.
- 2015**     *Optimal recruitment strategies in groups of interacting walkers with leaders.* 113<sup>th</sup> Conference on Statistical Mechanics. New Brunswick NJ, USA. May 10-12.
- 2013**     *Optimizing the search for resources sharing information. The case of Mongolian gazelles.* III Summer School, Statistical Physics of Complex and Small Systems. Palma, Spain. September 2-13.
- 2013**     *Optimizing the search for resources sharing information. The case of Mongolian gazelles.* Models in Population Dynamics and Ecology. Osnabruck, Germany. August 26-29.
- 2012**     *A nonlocal spatial model for savannas.* Search and Stochastic Phenomena in Complex Physical and Biological Systems. Palma, Spain. May 28 - June 1.
- 2011**     *Temporal Griffiths Phases.* I Summer School on Statistical Physics of Complex and Small Systems. Palma, Spain. September 12-23.
- 2010**     *Generating maximum entangled states between two simple atomic systems.* III Conference of Physics Students (COEFFIS). La Laguna, Spain. March 18-19.

### Poster presentation

- 2017**     *Cell adhesion and fluid flow jointly initiate biofilm genetic structure.* Life Sciences Research Foundation Annual Meeting. Baltimore MD, USA. October 20-22.
- 2017**     *Lack of ecological and life-history context can create the illusion of social interactions.* Workshop on Systems Biology and Molecular Economy of Microbial Communities. Trieste, Italy. July 3-7.

- 2017** *Lack of ecological and life-history context can create the illusion of social interactions.* Crossroads in the Complex Systems. Palma, Spain. June 5-8.
- 2017** *Non-aggregated cells can favor the persistence of multicellular fruiting bodies against destructive social cheaters in Dictyostelium discoideum.* 1st Biology for Physics Conference: Is there new Physics in Living Matter? Barcelona, Spain. January 15-18.
- 2016** *Using D. discoideum to understand the role of ecology and multiple fitness tradeoffs in the evolution of multicellularity.* Life Sciences Research Foundation Annual Meeting. Seattle WA, USA. October 14-16.
- 2014** *Vegetation pattern formation in semiarid systems without facilitative mechanisms.* EGU General Assembly. Vienna, Austria. April 27 – May 2.
- 2014** *Vegetation pattern formation in semiarid systems without facilitative mechanisms.* XIX FisEs. Ourense, Spain. April 2-4.
- 2013** *Spatial patterns in mesic savannas: the local facilitation limit and the role of demographic stochasticity.* Models in Population Dynamics and Ecology. Osnabruck, Germany. August 26-29.
- 2013** *Optimizing the search for resources sharing information. The case of Mongolian gazelles.* STATPHYS25. Seoul, South Korea. July 22-26.
- 2012** *A long range interaction model for foragers.* XVIII FisEs. Palma, Spain. October 18-20.
- 2012** *A nonlocal spatial model for savannas.* XVIII FisEs. Palma, Spain. October 18-20.
- 2011** *Temporal Griffiths Phases.* XVII FisEs. Barcelona, Spain. June 2-4.

## Teaching & student mentoring

- 2017** Co-advisor of a Master Thesis in the Master in Physics of Complex Systems, IFISC. Thesis title: “*Modelling quorum sensing mechanisms in bacterial populations*”.
- 2016** Co-advisor of a Graduate Student Rotation. Program in Quantitative and Computational Biology, Princeton University.
- 2016** Co-advisor of two undergraduate students. SURF summer internship, IFISC.
- 2015-** International Mentor Program. International Mentoring Foundation for the Advancement of Higher Education. 2 Graduate students, 1 Master student and 1 Undergraduate student
- 2015-16** EEB 325. *Mathematical modelling in biology and medicine.* Precepts on scientific programming (10 hours). Princeton University.
- 2013** Co-advisor of one undergraduate student. IFISC-Intro summer program.

## Outreach activities

### Presentations

- 2014** *Aplicaciones de la Física Estadística en Ecología: patrones de vegetación y movimiento de animales* (in Spanish). Monserrat Casas awards Ceremony.

### Articles:

- 2013** *La comunicación entre individuos podría optimizar la búsqueda de recursos en algunas especies.* R. Martínez-García and C. López. Física Hoy, RSEF (In Spanish).

### **Long stays (more than 4 weeks)**

- 2017** Institute for Cross-Disciplinary Physics and Complex Systems (8 weeks).
- 2015** Institute for Cross-Disciplinary Physics and Complex Systems (5 weeks).
- 2012** Smithsonian Conservation Biology Institute (12 weeks).
- 2011** Max Planck Institute for the Physics of Complex Systems (5 weeks).

### **Short visits (less than 4 weeks)**

- 2017** Departamento de Física, Universitat Autònoma de Barcelona.
- 2016** Department of Biology, University of Maryland.
- 2014** Instituto Mediterraneo Estudios Avanzados, IMEDEA (CSIC-UIB).
- 2014** Institute for Chemistry and Biology of the Marine Environment. Carl von Ossietzky University, Oldenburg.

### **Academic referee**

eLife, Physical Review Letters, Physical Review E, Physical Review E Rapid Communications, Ecological Modelling, Ecological Complexity, The American Naturalist, Journal of Theoretical Biology.

### **Professional society membership**

- 2016--** American Association for the Advancement of Sciences, AAAS.
- 2016--** Spanish Royal Society of Physics, RSEF.
- 2014--** Society of Mathematical Biology, SMB.
- 2014--** European Society of Mathematical and Theoretical Biology, ESMTB.
- 2014--** Spanish Scientists in the USA, ECUSA.
- 2012--15** Optical Society of America, OSA.

### **Other skills and competences.**

- Programming languages: Fortran, Mathematica, Bash.
- Basic knowledge of PHP, Python and Javascript.
- Operating systems: Linux, Windows.