**Home page**

When we find a landmark (in Spanish "hito") we do not see only a bunch of stones. We know that

it is extremely unlikely to find them in that position unless someone stacked them on purpose. This is a nice metaphor explaining my motivation for biology, because it contains the most intriguing questions surrounding the origin and evolution of life: Why life seems to run away from high entropy states? Why it spontaneously creates and stores information? How can we model the emergent patterns arising from biological processes? In this website you will find information about my research and some more... Welcome!

**Research**

***Intro***

'I am physicist with (real) interest in biology. I did my PhD in the Center for Molecular Biology Severo Ochoa in Madrid (CSIC-UAM) under the supervision of [Dr. Ugo Bastolla]. I then moved to the Microbial Ecology laboratory of Imperial College London, leaded by [Dr. Thomas Bell], where I am Research Associate. I focus on complex biological systems at different scales, from molecules to large ecosystems, considering experimental data whenever is possible. In the following, I briefly describe some areas of interest, from microscopic to macroscopic systems.

***Proteins***

'Protein structures play a fundamental role to understand the complex relationship between protein function and evolution as they allow us to incorporate physical principles into evolutionary analysis. My work aims to understand which effects have the main evolutionary events in protein structures, through the analysis of the topological properties of the protein structure space and the relationship between protein structures and protein sequences divergences, among other questions.

***Microbes***

The vast number and ubiquity of microbes makes them vital for a variety of processes, from global carbon balance to antibiotic pathogenesis. However, we are still far from getting a clear picture of the ecological and evolutionary determinants shaping bacterial communities, which is necessary for the control and further development of any potential application. I am interested in the integration of top-down and bottom-up computational methods, combining statistical analysis from natural samples and genome-based models. My aim is to shed light in the complex relation between bacterial biodiversity and community function.

***Mutualistic*** ***systems***

The relationship between biodiversity and stability in complex ecosystems has been the subject of intense theoretical research. I am interested in deciphering which is the role that the different species interactions have on this relationship, with particular emphasis on the role of mutualistic interactions. Mutualism has been historically considered detrimental for biodiversity, overemphasizing the role of competitive interactions. We are challenging this view with a fresh perspective based on the importance of structural stability.

***Epistemology***

I am also interested in the epistemological questions surrounding the study of complex systems. In particular, I am developing a novel approximation based on intuitionistic logic, aiming to provide a sharp definition of the concept of emergence, a question that has attracted much controversy in the literature.

**Teaching**

***Bioinformática con Ñ***

I coordinated with Álvaro Sebastián the development of a book of Bioinformatics in Spanish, more than 500 pages written by several scientists and made freely accessible [here](https://www.scribd.com/doc/231270078/Bioinformatica-con-N). In the following link, you can download the chapters I contributed (see "Book Chapters")

***Structural bioinformatics***

I summarized with the help of my collaborators the lectures that me and Ugo Bastolla provided at the Universidad Autónoma de Madrid (MSc. on Biophysics) in an article in which we use a wooden snake puzzle to teach complex questions on protein structure folding and evolution.

***Maths for biology***

I am responsible of the module "Maths for Biology" in the MSc of Computational Methods of Ecology and Evolution at Imperial College London (Silwood Park).

***Secondary school***

I worked in several public institutions and in a private company to teach science and information processing skills to secondary school kids.

**Outreach**

I am engaged in different projects to disseminate science to a broad audience and to promote fair and transparent scientific publishing.

\* Working member of [OpenScholar].

> OpenScholar is a non-for-profit organization in which we advocate for a change in the way in which science is disseminated. Among several projects, the organization governs an independent peer-review platform called [Self-JournalS of Science], where editors, authors and referees develop science in a completely transparent way.

\* Ecobuilder Game (play [here]).

> An ambitious project leaded by [Samraat Pawar] to teach species ecosystem assembly.

\* Member of [Native Scientist]

> This is a NGO promoting scientific dissemination for kids whose mother tongue is different than the language of the country they live.

\* Collaborator of [Alleen](http://www.aleen.org/).

> A private company that promotes the public dissemination of Science and the interaction between private companies and academics.

\* Founder and administrator of [BIOCOMP].

> The email network list on Computational Biology of the Spanish Academic Network.

\* Collaborator of the scientific radio program [Parallel Universe].