

IGNACIO MADRID

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RESEARCH INTERESTS

Interested in the interplay between different scales of living systems, linking probabilistic and deterministic approaches. Current applications of interest include the modelling of heterogeneous microbial populations, the study of their long-time behaviour, fitness, and the development of statistical tools to infer quantities of interest from single-cell lineages, which allow to link individual and population data.

EDUCATION

Ph.D. (c) Applied Mathematics Palaiseau, France, 2020 - present
CMAP, ÉCOLE POLYTECHNIQUE

Title: Modelling cell growth under stress: Emergence of heterogeneity, and Impact of the environment
Supervision: Sylvie Méléard (CMAP) and Meriem El Karoui (U. of Edinburgh)

M.Sc. Applied Mathematics for Life Sciences (M2) Palaiseau, France, 2018 - 2019
UNIVERSITÉ PARIS-SACLAY & ÉCOLE POLYTECHNIQUE

Awarded the *Sophie Germain* Scholarship, Fondation Mathématique Jacques Hadamard
Graduated with highest honors.

Engineering degree (*Ingénieur polytechnicien*) Palaiseau, France 2015 - 2019
ÉCOLE POLYTECHNIQUE

M.Sc. Applied Mathematics (M1), Major in Data Science

Computational and Mathematical Engineering degree Santiago, Chile, 2013 - 2020
PONTIFICIA UNIVERSIDAD CATÓLICA DE CHILE

(Double Degree with École polytechnique)
Graduated with highest honors. Awarded the *Alberto Hurtado* Scholarship during studies.

RESEARCH STAYS AND EXPERIENCE

CEMRACS 2022 CIRM, Marseille, France, Summer 2022

- 5 weeks research project on the modelling of the collective motion of *Myxococcus xanthus* bacteria. Supervised by Vincent Calvez, Florence Hubert, Magali Tournus and Julien Olivier.

El Karoui Lab, University of Edinburgh Edinburgh, UK, Dec 2021

- Initiation to microfluidic techniques and acquisition of data on which my PhD thesis is based.

**Applied Microfluidic Systems Lab (Fujii Lab) and
Laboratory for Integrated Micro-Mechatronic Systems (LIMMS), CNRS IRL 2820
Institute of Industrial Science, The University of Tokyo** Tokyo, Japan, Apr - Sep 2019
Masters Research Internship

- Worked on the modelisation and simulation of single-electron transport for DNA-based biosensors.
- Selected for talk and poster at the 2nd Mechanobiology Meeting (Vietnam, 2019), and awarded with the NTT-BRL Fellowship to attend the ISNTT Symposium (Japan, 2019).

**Group of Applied Mathematics and Computational Biology
Institut de Biologie de l'École normale supérieure** Paris, France, Mar - Aug 2018
Masters Research Internship

- Worked on the modelisation and simulation of DNA repair using random polymer models.
- Distinguished with the Congratulations of the Jury of the Department of Applied Mathematics.

Servier Chemogenetics Lab at the Brain and Spine Institute (ICM)

Institut de Recherches **SERVIER**

Paris, France, Aug - Sep 2017

Engineer Research Internship

- Performed image analysis and statistical characterization of hippocampus neuronal cultures.

INVITED TALKS

- International Workshop on CNRS - Industry Collaborations for the 15th year anniversary of collaboration between CNRS and NTT Basic Research Labs. IIS, The University of Tokyo, 2023 (online).
- Doctoral seminar, LJLL, Sorbonne Université, 2023.
- Seminar of Probability PhD students, IRMAR, Rennes, 2023.
- Mathematical Biology on the Mediterranean Conference, 3rd edition, FORTH, Crete, 2022.
- Workshop Group NOLO (Non-Local Branching Processes). Montpellier, France. June 2022.
- Mathematical Models in Ecology and Evolution. Thematic trimester on Mathematical modeling of organization in living matter. Institut Henri Poincaré. Paris, France. March 2022
- Spring Research School of the Chaire Modélisation Mathématique et Biodiversité, École polytechnique - Veolia. Aussois, France. June 2021
- Seminar of the Institute of Computational and Mathematical Engineering, Pontificia Universidad Católica de Chile. Santiago de Chile. June 2021.
- 4th Congress of Engineering Students, Santiago de Chile. August, 2020. Best Paper Award.
- 2nd Mechanobiology Meeting: When Physics meet Biology. ICISE, Quy Nhon, Vietnam. July 2019.

PUBLICATIONS

- [1] I. Madrid. “Exponential ergodicity of a degenerate age-size piecewise deterministic process”. *Acta Appl Math* 187, 5 (2023).
- [2] I. Madrid, Z. Zheng, C. Gerbelot, et al. “Ballistic Brownian motion of nanoconfined DNA”. *ACS Nano* 17, 17 (2023).
- [3] Y. Kutovy, I. Madrid, N. Boichuk, et al. “Single-trap phenomena stochastic switching for noise suppression in nanowire FET biosensors”. *Jpn. J. Appl. Phys.* 60 SBBG03 (2021). *Highlighed paper*.
- [4] Y. Kutovy, I. Madrid, I. Zadorozhnyi, et al. “Noise suppression beyond the thermal limit with nanotransistor biosensors”. *Sci Rep* 10, 12678 (2020).

TEACHING

- Tutorials of Probability. First year Polytechnique engineer students. 2020-present.
- Teaching assistance (TD) of Introduction to Probability. Second year Polytechnique Bachelor students. 2020-present.
- Teaching assistance of Calculus and Linear Algebra. Pontificia Universidad Católica de Chile. 2014-2015.

TECHNICAL SKILLS

Programming Languages	Python, R, C++, Experience with GPU computing
	Spanish: native
	French: fluent
	English: fluent
	Japanese: intermediate (JLPT N3)