

Mariano Beguerisse-Díaz

Mathematical Institute
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Research interests

Mathematics of data science, computational social science, human dynamics, information retrieval.

Networks, complexity, dynamics on/of networks, network algorithms.

Mathematical biology and interdisciplinary applications, mathematical modelling, parameter inference.

Employment

University of Oxford

Senior Research Fellow December 2015 – Present

Oxford-Emirates Data Science Lab, Mathematical Institute

Consumer analytics, computational social science, data science, temporal networks, textual analysis, mathematical biology.

Imperial College London

Research Fellow October 2011 – November 2015

James S. McDonnell Foundation postdoctoral fellowship in complexity

Department of Mathematics and Department of Chemistry

Community structure of directed and temporal networks, flow-roles, analysis of textual data with applications to medical anthropology, sociology, economics and computational neuroscience.

Eficiencia Informativa

Data scientist December 2003 – August 2007

Design, development and maintenance of systems to process, classify, and aggregate news stories from Mexican and international media by topic and importance.

Education

Imperial College London 2012

PhD Mathematical Biology

Dissertation: *Modelling of Integrated Signalling Networks in Stomatal Guard Cells.*

University of Oxford 2008

MSc Mathematical Modelling and Scientific Computing.

Dissertation: *Analysis of a Bipartite Network of Movie Ratings and Catalogue Network Growth Models.*

Instituto Tecnológico Autónomo de México (ITAM) 2007

BSc Applied Mathematics.

Dissertation: *Un Sistema de Atribución de Textos Basado en Teoría de la Información*
(A System for the Attribution of Texts Based on Information Theory).

Honours and awards

Somerville College Oxford. Fulford Junior Research Fellowship	2016 – 2018
James S. McDonnell Foundation Postdoctoral Fellowship (US\$ 200,000)	2012 – 2014
BBSRC-Microsoft Research Dorothy Hodgkin Postgraduate Award (£90,000)	2008 – 2011
Chevening Scholar. Foreign and Commonwealth Office – British Council (£22,000)	2007 – 2008

Affiliations

EPSRC Centre for the Mathematics of Precision Healthcare, Imperial College London, Co-investigator	2016 – Present
Social and Cultural Analytics Lab, Imperial College London	2015 – Present
Sinnia, Scientific Advisor	2013 – Present
Department of Engineering Science, University of Oxford, Visiting Fellow	2014 – 2015
Institute of New Economic Thinking, University of Oxford, Visiting Fellow	2014 – 2015
School of Engineering and Applied Sciences, University of Pennsylvania, Visiting Fellow	2013

Publications

12. D.J.P. O'Sullivan, G. Garduño-Hernández, J.P. Gleeson, **M.B.D.**
Integrating sentiment and social structure to determine preference alignments: The Irish Marriage Referendum.
Royal Society Open Science (In press). arXiv:1701.00289.
11. **M.B.D.**, A.K. McLennan, G. Garduño-Hernández, M. Barahona, S.J. Ulijaszek.
The 'who' and 'what' of #diabetes on Twitter.
Digital Health 2017 3 2055207616688841.
10. **M.B.D.**, R. Desikan, M. Barahona.
Linear models of activation cascades: analytical solutions and coarse-graining of delayed signal transduction.
J. R. Soc. Interface 2016 13 20160409.
9. K. Bacik, M.T. Schaub, **M.B.D.**, Y.N. Billeh, M. Barahona.
Flow-based network analysis of the Caenorhabditis elegans connectome.
PLoS Comput Biol 12(8): e1005055.
8. V. Martínez, M. A. Escalante, **M.B.D.**, E. Garduno, V. M. González.
Modelling and understanding human behavior in urban spaces: A mobility graph approach.
International Journal of Web Services Research Volume 13, Issue 4 (2016).
7. **M.B.D.**, G. Garduño-Hernández, B. Vangelov, S.N. Yaliraki, M. Barahona.
Interest communities and flow roles in directed networks: the Twitter network of the UK riots.
J. R. Soc. Interface 6 December vol. 11 no. 101 20140940 (2014).
6. **M.B.D.**, B. Vangelov, M. Barahona.
Finding role communities in directed networks using Role-Based Similarity, Markov Stability and the Relaxed Minimum Spanning Tree.
IEEE GlobalSIP 978-1-4799-0248-4/13 (2013).
5. H.A. Harrington, **M.B.D.**, M.P. Rombach, L.M. Keating, M.A. Porter.
Commentary: Teach network science to teenagers.
Network Science Volume 1, Issue 02, pp 226-247 (2013).
4. **M.B.D.**, M. Hernández-Gómez, A.M. Lizzul, M.Barahona, R. Desikan.
Compound stress response in stomatal closure: a mathematical model of ABA and ethylene interaction in guard cells.
BMC Systems Biology, 6:146 (2012).

3. H.A. Harrington, M. Komorowski, **M.B.D.**, G.M. Ratto, M.P.H. Stumpf.
Mathematical modeling reveals the functional implications of the different nuclear shuttling rates of Erk1 and Erk2.
Physical Biology 9, 036001 (2012).
2. **M.B.D.**, B. Wang, R. Desikan, M. Barahona.
Squeeze-and-Breathe Evolutionary Monte Carlo Optimisation with Local Search Acceleration and its applications to parameter fitting
J. R. Soc. Interface, vol. 9 no. 73 1925-1933 (2012).
1. **M.B.D.**, M.A. Porter, J-P. Onnela.
Competition for popularity in bipartite networks.
Chaos 20, 043101 (2010).

Submitted manuscripts

2. A. Seigal, **M.B.D.**, B. Schoeberl, M. Niepel, H.A. Harrington
Tensors and algebra give interpretable groups for crosstalk mechanisms in breast cancer
arXiv:1612.08116.
1. **M.B.D.**, G. Bosque, D. Oyarzún, J. Picó, M. Barahona.
Flux-dependent graphs for metabolic networks
arXiv:1605.01639.

Book chapters

1. A.K. McLennan, S.J. Ulijaszek, **M.B.D.**
Who talks about diabetes on Twitter, what do they say, and why are there so many jokes?
In T. Schneider, K. Eli, C. Dolan, S. Ulijaszek. (Eds.) *Digital Food Activism*. Routledge, 2016

Technical reports

2. **M.B.D.**, L. Bridge, C.B. Miron, S. Pearce, M. Qian, K. Franklin.
Assessing the adaptive significance of plant architectural adaptations to elevated temperature.
Mathematics in the Plant Sciences Study Group III, University of Nottingham, 14-17 December 2009.
1. S. McCue, T. Bartsch, R. Dyson, **M.B.D.**, O. Jensen.
Modelling Cell Separation During Plant Organ Abscission.
Mathematics in the Plant Sciences Study Group II, University of Nottingham, 5-8 January 2009.

Unsubmitted manuscripts available on request

7. R. García-Millán, A. Papachristodoulou, **M.B.D.** *Managing antibiotic resistance with optimal control.*
6. W. Ahmad, M.A. Porter, **M.B.D.** *Continuous-time temporal networks with tie decay.*
5. R. Mendoza-Smith, **M.B.D.** *Sparse teleportation for directed networks.*
4. E. Bamis, **M.B.D.**, M. Barahona. *Wasserstein Distance Properties for Comparing Probabilistic Partitions*
3. A. Sonabend, F. Pérez-Cervantes, **M.B.D.**. *Transport Network Centrality as a Precursor of Growth: Evidence from the United States 1840-1900.*
2. Y. Asano, W. Ahmad, S. Vary, A. Kekić, Y. Zhao, J.D. Farmer, **M.B.D.** *Uncovering technological eras using patent incidence networks.*
1. **M.B.D.**, E. Garduno, G. Garduño-Hernández, S.N. Yaliraki, M. Barahona. *Topic timelines: Tracking the evolution of collective narratives in online social networks.*

Doctoral student supervision

3. Jonathan Peters. *Integrated information for organisational complexity*. Doctoral Training in Industrially Focused Mathematical Modelling (InFoMM), Mathematical Institute, University of Oxford (2016-2019). Co-supervision with Yakov Kremnitzer and Christian Bick.
2. Fabian Ying. *Modelling and analysis of spatio-temporal networks in supermarkets*. Doctoral Training in Industrially Focused Mathematical Modelling (InFoMM), Mathematical Institute, University of Oxford (2016-2019). Co-supervision with Mason A. Porter and Sam Howison.
1. David O'Sullivan. *Complex contagion on networks*. Department of Mathematics & Statistics, University of Limerick, Ireland (2015-2018). Co-supervision with James Gleeson.

Masters student supervision

14. François Hulot *Modelling economic diversification: diffusion, complementarity and shocks*. Co-supervised with Neave O'Clery. MSc Mathematical Modelling and Scientific Computing, Mathematical Institute, University of Oxford 2017.
13. Giuseppe Ugghi. *Using data and networks to unravel the forces of urban agglomeration*. Co-supervised with Neave O'Clery. MSc Mathematical Modelling and Scientific Computing, Mathematical Institute, University of Oxford 2017.
12. Jake Yudelowitz. *Network Decomposition for Airline Revenue Optimisation*. Co-supervised with Jaroslav Fowkes. MSc Mathematical Modelling and Scientific Computing, Mathematical Institute, University of Oxford 2017.
11. Zetian Gao. *Spatiotemporal analysis of air travel networks*. Co-supervised by Antti Tolvanen. MSc Mathematical Modelling and Scientific Computing, Mathematical Institute, University of Oxford 2017.
10. Rodrigo Leal Cervantes. *Network analysis of an online travel community* (In collaboration with Travel Massive). MSc Mathematical Modelling and Scientific Computing, Mathematical Institute, University of Oxford 2017.
9. Rosalba García-Millán. *Optimal control of antibiotic resistance*. MSc Mathematical Modelling and Scientific Computing, Mathematical Institute, University of Oxford 2016. Co-supervision with Antonis Papachristodoulou.
8. Walid Ahmad. *Continuous-time analysis of temporal networks*. MSc Mathematical Modelling and Scientific Computing, Mathematical Institute, University of Oxford 2016. Co-supervision with Mason Porter.
7. Alexandre Manai. *Context-dependent metabolic networks: structure and dynamics*. MSc Mathematical Modelling and Scientific Computing, Mathematical Institute, University of Oxford 2016. Co-supervision with Eamonn Gaffney.
6. Timothée Goubault de Brugière. *Network analyses based on flows*. MSc in Applied Mathematics, Department of Mathematics, Imperial College London 2015.
5. Aron Cruise. *Network analysis of online radicalisation: fighters in Iraq and Syria..* Department of Mathematics, Imperial College London 2015.
4. Andrew Maher. *Analysis of temporal networks*. MSc in Applied Mathematics, Department of Mathematics, Imperial College London 2014. Co-supervision with Mauricio Barahona.
3. Andrey Sokolov. *Structural analysis of metabolic networks*. MSc in Applied Mathematics, Department of Mathematics, Imperial College London 2014. Co-supervision with Diego Oyarzún Mauricio Barahona.
2. Lars Bergemann. *Activation Cascades In Cell Signalling: Deterministic and Stochastic Models*. Department of Mathematics, Imperial College London 2012. Co-supervision with Mauricio Barahona.
1. Alessandro Lizzul. *Stomatal closure and systems biology* MRes in Plant Biotechnology, Division of Life Sciences, Imperial College London 2011. Co-supervision with Radhika Desikan.

Undergraduate student supervision

4. Ioannis Papadopoulos. Undergraduate research project (LMS-funded, co-supervised with M. Barahona and J. Stroud), Department of Mathematics, Imperial College London 2015.
3. Karol Bacik. Undergraduate Summer research project (UROP, with M. Barahona and M. Schaub), Department of Mathematics, Imperial College London 2014.
2. Ioannis Papadopoulos. Undergraduate Summer research project (UROP, with M. Barahona and M. Schaub), Department of Mathematics, Imperial College London 2014.
1. Yi (Aaron) Low. Undergraduate Summer research project (UROP, with M. Barahona and M. Schaub), Department of Mathematics, Imperial College London 2014.

Teaching

4. Case studies in mathematical modelling: *Economic networks, a comparison of Irish and Swedish data*. MSc in Mathematical Modelling and Scientific Computing. Mathematical Institute, University of Oxford, 2017.
3. Case studies in mathematical modelling: *Evolution and classification of technological innovation: A data-driven approach*. MSc in Mathematical Modelling and Scientific Computing. Mathematical Institute, University of Oxford, 2016.
2. Lecture course on Network Science (40 hours) for the MSc in Data Science. Instituto Tecnológico Autónomo de México (ITAM), 2014.
1. Graduate teaching assistant and marker in Mathematics, Modelling in Biology, and Advanced Biological Modelling courses for first and third year undergraduates and MSc students. Department of Bioengineering, Imperial College London, 2010-2011, 2012-2013, 2013-2014.

Examiner

Doctoral examinations (*viva voce*).

2. Andrew Elliot 5 April 2017
Department of Management Studies, University of Oxford
Path-based sampling and community detection methods for biological and other applications
External examiner: Mark Newman (Michigan).
1. Malte Lücken 24 March 2017
Department of Statistics, University of Oxford
Application of multi-resolution partitioning of interaction networks to the study of complex disease
External examiner: Michael Stumpf (Imperial).

Doctoral transfers and confirmation examinations.

2. Jake Taylor-King 7 October 2016.
Mathematical Institute, University of Oxford.
Confirmation thesis: *Mathematical modelling of healthy and cancerous microenvironments: Osteocyte network formation and histology analysis*
Other examiner: Eamonn Gaffney (Maths, Oxford).
1. Florian Klimm 5 July 2016
Mathematical Institute, University of Oxford
Transfer thesis: *Multilayer networks and protein interaction analysis*
Other examiner: Gesine Reinert (Stats, Oxford).

Invited Talks

32. Data Science Seminar, University of Manchester March 21, 2017.
31. North meets South Colloquium, University of Oxford March 10, 2017.
30. CCMI Seminar, University of Cambridge February 10, 2017.
29. Industrial and Applied Mathematics Seminar, University of Oxford January 26 2017
28. London Aviation Festival September 9 2016.
27. Digital Food Activism An Oxford Food Governance Group Workshop.
University of Oxford November 25 2015.
26. Conference on network models, stress testing and other tools
for financial stability monitoring and macroprudential policy design
and implementation, Banco de México November 11-12 2015.
25. Junior Applied Mathematics seminar, Imperial College London October 29 2015.
24. Dynamic Networks and Cyber-Security University of Bristol June 23 2015.
23. MACSI seminar, University of Limerick September 4 2015.
22. Applied Mathematics Seminar, University of Southampton October 20 2015.
21. Complexity Seminar, Warwick University November 18 2015.
20. NetSciEd15, NetSci 2015, Zaragoza, Spain June 1 2015.
19. Mathematics Colloquium. Institute of Mathematics,
Universidad Nacional Autónoma de México, Querétaro May 6 2015.
18. Colombian Biomathematics Symposium. Universidad de Sucre, Colombia April 24 2015.
17. Biomathematics seminar, Imperial College London March 10 2015.
16. Mathematics of Human Behaviour Seminar University of Reading March 18 2015.
15. Bioengineering seminar, Instituto de Automática e Informática Industrial,
Universitat Politècnica de València February 18 2015.
14. CABDyN complexity centre seminar, University of Oxford February 3 2015.
13. Department of Engineering Science, University of Oxford March 4 2015.
12. Oxford Internet Institute, University of Oxford January 7 2015.
11. Instituto Tecnológico Autónomo de México November 26 2014.
10. Institute of Social and Cultural Anthropology, University of Oxford February 6 2014.
9. Mathematical Institute, University of Oxford January 15 2014.
8. Workshop on Inference, Identifiability and Model Selection,
Mathematical Institute, University of Oxford November 28 2013.
7. MSc programme talk in Data Science,
Instituto Tecnológico Autónomo de México October 24 2013.
6. UBVO Seminar, Institute of Social and Cultural Anthropology,
University of Oxford March 23 2013.
5. Biomathematics Seminar, Imperial College London March 13 2012.
4. Applied Mathematics Seminar, Universidad Autónoma de Querétaro October 29 2009.
3. Complexity Oxford-Imperial College (COXIC) workshop.
Institute for Mathematical Sciences, Imperial College London April 21 2010.
2. Division of Biology, Imperial College London August 25 2009.
1. Biomathematics Seminar, Imperial College London June 1 2009.

Contributed Talks

7. Conference in Complex Systems, Amsterdam. September 2016.
6. NetSci 2015, Zaragoza, Spain June 5 2015.
5. International Conference on Computational Social Science, Helsinki, Finland June 10 2015
4. SIAM workshop on network science. Chicago, Illinois July 7 2014.
3. Temporal Networks, Human Dynamics and Social Physics (TnetSphys14),
NetSci2014. UC Berkeley June 3 2014.
2. CODYM meeting, ECCS 2012, ULB, Brussels, Belgium. September 2 2012
1. Young Researchers in Mathematics 2011. University of Warwick, Coventry April 15 2011.

Service

- Co-Chair of the Early Career Researchers Committee,
Mathematical Institute, University of Oxford 2016 – Present.
- Co-organiser of the Summer School in Economic Networks.
Mathematical Institute, University of Oxford June 26-30 2017.
- Co-organiser of the Networks Symposium,
British Applied Mathematics Colloquium, University of Sussex, April 10-12 2017.
- Organizer, Networks and Dynamics Journal Club. Imperial College London 2013 – 2014
- Co-chair, Complex Networks and Dynamics satellite workshop
4th International Conference on Complex Systems and Applications,
Le Havre, France June 23-26 2014

Outreach:

Design of network science outreach programme and outreach activities for year 9-12 students in schools in the UK, US, and Mexico.

Refereeing:

<i>Automatika</i>	<i>IEEE Transactions on Signal Processing</i>
<i>Bioinformatics</i>	<i>Journal of Complex Networks</i>
<i>Computational Social Networks</i>	<i>Journal of the Royal Society Interface</i>
<i>European Physical Journal B</i>	<i>Physica A</i>
<i>European Physical Journal Data Science</i>	<i>Physical Review E</i>
<i>Europhysics Letters</i>	<i>Physical Review Letters</i>
<i>IEEE Transactions on Network Science and Engineering</i>	<i>PLoS One</i>
	<i>SIAM Undergraduate Research Online</i>

Membership of professional organisations

<i>The Complex Systems Society.</i>	<i>Network Science Society.</i>
<i>IEEE.</i>	<i>SIAM.</i>

Languages

Spanish (native), English (expert), German (advanced).