Jorge Peña

Institute for Advanced Study in Toulouse, 1 Esplanade de l'Université
31080 Toulouse Cedex 6 – France

+33 561 12 86 93 • jorge.pena@iast.fr • jorgeapenas.github.io

June 11, 2022

Academic Positions

Assistant Professor/Tenure-Track Researcher — **Toulouse, France**
Institute for Advanced Study in Toulouse, University of Toulouse 1 Capitole — *since September 2017*

Postdoctoral Fellow — **Kiel, Germany**
Geomar Helmholtz Centre for Ocean Research Kiel — *September 2016 – August 2017*
Advisor: Prof. Oscar Puebla

Postdoctoral Fellow — **Plön, Germany**
Max Planck Institute for Evolutionary Biology — *September 2013 – August 2016*
Advisor: Prof. Arne Traulsen

Postdoctoral Fellow — **Basel, Switzerland**
Faculty of Business and Economics, University of Basel — *April 2012 – August 2013*
Advisors: Prof. Georg Nöldeke and Prof. Laurent Lehmann

Graduate Assistant — **Lausanne, Switzerland**
Faculty of Social and Political Sciences, University of Lausanne — *September 2006 – August 2011*

Fixed-term Part-time Lecturer — **Medellín, Colombia**
Faculty of Electronics Engineering, Universidad Pontificia Bolivariana — *January 2004 – August 2005*

Education

Ph.D. in Applied Mathematics for the Human and Social Sciences
Faculty of Social and Political Sciences, University of Lausanne, Lausanne, Switzerland — *2012*
Dissertation title: "Conformity, upstream reciprocity and social diversity: secondary mechanisms for the evolution of cooperation"
Supervisors: Prof. Henri Volken and Prof. Marco Tomassini

M.A.S. in Embedded Systems Design
University of Lugano, Lugano, Switzerland — *2006*

Electronics Engineering
Universidad Pontificia Bolivariana, Medellín, Colombia — *2004*
5-year degree

Research Interests

Theoretical biology, evolutionary ecology, and game theory; special focus on social evolution theory and collective action problems

Publications

Refereed Journals

Cooper, G.A., Liu, M., **Peña, J.**, West, S. A. (2022) The evolution of mechanisms to produce phenotypic heterogeneity in microorganisms. *Nature Communications* 13, 195

González-Forero, M., **Peña, J.** (2021). "Eusociality through conflict dissolution." *Proceedings of the Royal*

Society B. 288: 2021038620210386

Nöldeke, G., **Peña, J.** (2020). "Group size and collective action in a binary contribution game." *Journal of Mathematical Economics* 88, 42-51

Peña, J., Nöldeke, G., Puebla, O. (2020). "The evolution of egg trading in simultaneous hermaphrodites." *The American Naturalist* 195(3), 524-533

Estrela, S., Libby, E., Van Cleve, J., Débarre, F., Deforet, M., Harcombe, W. R., **Peña, J.**, Brown, S. P., Hochberg, M. E. (2019). "Environmentally mediated social dilemmas." *Trends in Ecology & Evolution*, 34(1), 6-18

Peña, J., Nöldeke, G. (2018). "Group size effects in social evolution." *Journal of Theoretical Biology*, 457, 211-220

Pichugin, Y., **Peña, J.**, Rainey, P., Traulsen, A. (2017). "Fragmentation modes and the evolution of life cycles." *PLOS Computational Biology* 13(11): e1005860

dos Santos, M., **Peña, J.** (2017). "Antisocial rewarding in structured populations." *Scientific Reports* 7: 6212

Peña, J., Wu, B., Arranz, J., Traulsen, A. (2016). "Evolutionary games of multiplayer cooperation on graphs." *PLOS Computational Biology* 12(8): e1005059

Nöldeke, G., **Peña, J.** (2016). "The symmetric equilibria of symmetric voter participation games with complete information." *Games and Economic Behavior*, 99, 71-81

Peña, J., Wu, B., Traulsen, A. (2016). "Ordering structured populations in multiplayer cooperation games." *Journal of the Royal Society Interface*, 13: 20150881

Peña, J., Nöldeke, G. (2016). "Variability in group size and the evolution of collective action." *Journal of Theoretical Biology*, 389, 72-82

Peña, J., Nöldeke, G., Lehmann, L. (2015). "Evolutionary dynamics of collective action in spatially structured populations." *Journal of Theoretical Biology*, 382, 122-136

Peña, J., Lehmann, L., Nöldeke, G. (2014). "Gains from switching and evolutionary stability in multi-player matrix games." *Journal of Theoretical Biology*, 346, 23-33

Peña, J., Rochat, Y. (2012). "Bipartite graphs as models of population structures in evolutionary multiplayer games." *PLOS ONE*, 7(9): e44514

Peña, J. (2012). "Group-size diversity in public goods games." *Evolution*, 66, 623-636

Buesser, P., **Peña, J.**, Pestelacci, E., Tomassini, M. (2011). "The influence of tie strength on evolutionary games on networks: an empirical investigation." *Physica A*, 390, 4502-4513

Peña, J., Pestelacci, E., Berchtold, A., Tomassini, M. (2011). "Participation costs can suppress the evolution of upstream reciprocity." *Journal of Theoretical Biology*, 273, 197-206

Peña, J., Volken, H., Pestelacci, E., Tomassini, M. (2009). "Conformity hinders the evolution of cooperation on scale-free networks." *Physical Review E*, 80, 016110

Refereed Proceedings in Computer Science

Peña, J., Pestelacci, E., Tomassini, M., Volken, H. (2009). "Conformity and network effects in the prisoner's dilemma." In *Proceedings of the IEEE Congress on Evolutionary Computation, 2009*, pp. 506-513

Montes De Oca, M. A., **Peña, J.**, Stützle, T., Pinciroli, C., Dorigo, M. (2009). "Heterogeneous particle swarm optimizers." In *Proceedings of the IEEE Congress on Evolutionary Computation, 2009*, pp. 698-705

Peña, J. (2008). "Conformist transmission and the evolution of cooperation." In *Artificial Life XI: Proceedings of the Eleventh International on the Simulation and Synthesis of Living Systems*, pp. 458-465. MIT Press, Cambridge, MA

Peña, J. C., **Peña, J.**, Upegui, A. (2008). "Evolutionary graph models with dynamic topologies on the ubichip." In *Evolvable Systems: From Biology to Hardware. Proceedings of the 8th International Conference, ICES 2008*.

Lecture Notes in Computer Science 5216, pp. 59-70

Peña, J. (2008). "Simple dynamic particle swarms without velocity." In *Ant Colony Optimization and Swarm Intelligence. Proceedings of the 6th International Conference, ANTS 2008. Lecture Notes in Computer Science* 5217, pp. 144-154

Peña, J. (2008). "Theoretical and empirical study of particle swarms with additive stochasticity and different recombination operators." In *Proceedings of the 10th Annual Conference on Genetic and Evolutionary Computation, GECCO '08*, pp. 95-102. ACM, New York, NY

Peña, J., Upegui, A. (2007). "A population-oriented architecture for particle swarms." In *Proceedings of the Second NASA/ESA Conference on Adaptive Hardware and Systems, 2007*, pp. 563-570

Peña, J., Upegui, A., Sanchez, E. (2006). "Particle swarm optimization with discrete recombination: an online optimizer for evolvable hardware." In *Proceedings of the First NASA/ESA Conference on Adaptive Hardware and Systems, 2006*, pp. 163-170

Peña, J., Vanegas, M., Valencia, A. (2006). "Digital hardware architectures for Kohonen's self-organizing feature maps with exponential neighboring function." In *Proceedings of the IEEE International Conference on Reconfigurable Computing and FPGAs, 2006*, pp. 1-8

Talks and Posters

Invited Seminars

University of Graz, COLIBRI seminar, April 2022

Queen Mary University of London, Complex Systems Seminar, December 2020

Sorbonne Université, Laboratoire Jean Perrin, February 2019

University Claude Bernard Lyon, Laboratoire de Biométrie et Biologie Évolutive, October 2018

Aarhus University, Department of Bioscience, April 2018

Toulouse School of Economics, MAD-Stat seminar series, March 2018

University of St Andrews, School of Biology, July 2017

Monash University, Faculty of Information Technology, November 2016

Santa Fe Institute, June 2016

Institute for Advanced Study in Toulouse, May 2015

University of Lausanne, Department of Ecology and Evolution, June 2013

Max Planck Institute for Evolutionary Biology, Research Group for Evolutionary Theory, May 2013

Universidad Carlos III de Madrid, Departament of Mathematics, May 2012

Université Pierre & Marie Curie, Séminaires Ecologie et Evolution, May 2012

Universidad Pontificia Bolivariana, Escuela de Ingenierías, February 2012

Max Planck Institute for Evolutionary Biology, Research Group for Evolutionary Theory, November 2011

Universidad Pontificia Bolivariana, Escuela de Ingenierías, March 2011

Universidad EAFIT, Departamento de Ciencias Matemáticas, March 2011

Universidad de Antioquia, Departamento de Matemáticas, March 2011

Workshops and Conferences

SMB 2021, Virtual Society for Mathematical Biology Meeting, online talk

ESEB 2019 (Turku), Congress of the European Society for Evolutionary Biology, talk

MMEE 2019 (Lyon), Mathematical Models in Ecology and Evolution Conference, talk

Edinburgh Napier University, Workshop on Evolution and Dynamics of Institutions, May 2019, talk

EHBEA 2019 (Toulouse), 14th Annual Conference for the European Human Behaviour and Evolution Association, poster

Evolution 2018 (Montpellier), II Joint Congress on Evolutionary Biology, talk

SHOW 2018 (Paris), Simultaneously Hermaphroditic Organisms Workshop, talk

MMEE 2017 (London), Mathematical Models in Ecology and Evolution Conference, talk and poster

Max Planck Institute for Evolutionary Biology (Plön), Workshop on Conflict, Competition, Cooperation & Complexity Workshop, January 2016, talk

MMEE 2015 (Paris), Mathematical Models in Ecology and Evolution Conference, talk

Institute for Advanced Study in Toulouse, Toulouse Economics and Biology Workshop, June 2015, poster

ECMTB 2014 (Gothenburg), 9th European Conference on Mathematical and Theoretical Biology, talk

Max Planck Institute for Evolutionary Biology (Plön), Spatial Human Cooperation Meeting, May 2014, talk

Institute for Advanced Study in Toulouse, Toulouse Economics and Biology Workshop, May 2014, poster

Max Planck Institute for Evolutionary Biology (Plön), 6th Workshop on Theoretical Biology, talk

Inclusive Fitness and Game Theory Workshop (Arolla), May 2013, talk

University of Basel, 4th Bernoulli Workshop in Economics and Psychology, June 2012, talk

MMEE 2011 (Groningen), Mathematical Models in Ecology and Evolution Conference, poster

Social Decision Making: Bridging Economics and Biology Workshop (Monte Verità), March 2011, poster

ECCS 2010 (Lisbon), European Conference on Complex Systems, poster

SUNBELT XXX (Riva del Garda), SUNBELT Conference of the International Network for Social Network Analysis, talk

Evolution of Cooperation – Models and Theories Conference (Laxenburg), September 2009, poster

CEC 2009 (Trondheim), IEEE Congress on Evolutionary Computation, talk

ANTS 2008 (Brussels), 6th International Conference on Ant Colony Optimization and Swarm Intelligence, talk and poster

ALIFE 2008 (Winchester), 11th International Conference on Artificial Life, talk

GECCO 2008 (Atlanta), 10th Annual Conference on Genetic and Evolutionary Computation, talk

AHS 2007 (Edinburgh), 2nd NASA/ESA Conference on Adaptive Hardware and Systems, talk

AHS 2006 (Istanbul), 1st NASA/ESA Conference on Adaptive Hardware and Systems, talk

Grants and Awards

Swiss National Science Foundation – Early Mobility.Postdoc Fellowship. PBLAP3-145860: "Multiplayer game theory and the evolution of collective action." 42,500 CHF. 2013–2014

Swiss Government Excellence Scholarship for Foreign Scholars and Artists. 21,840 CHF. 2005–2006

Beca Municipio de Medellín a los Mejores Bachilleres. 1999–2003

Teaching Experience

"Mathematical models of social evolution" (Spring 2022, 7 CM hours; Spring 2021, 9 CM hours), Toulouse Summer School in Quantitative Social Sciences

"Population demography and evolutionary ecology" (Fall 2021, 24 CM hours; Fall 2020, 24 CM hours; Fall 2019, 24 CM hours; Fall 2018, 18 CM hours), Toulouse School of Economics, Master 2 Environmental and Natural Resource Economics (ERNA), Ecology and Economics path (EEC). (Segment: Matrix population models)

"Introduction to ecology for economists (M2EIGF2)" (Fall 2021, 15 CM hours; Fall 2020, 15 CM hours; Fall 2019, 15 CM hours; Fall 2018, 15 CM hours), Toulouse School of Economics, Master 2 Environmental and Natural Resource Economics (ERNA), Ecology and Economics path (EEC). (Segment: Introduction to population ecology)

"Mathématiques TD 15h (L1EPDD1)" (Fall 2019, 15 TD hours), Toulouse School of Economics, undergraduate course (Licence 1)

"Probabilités de gestion (LMAT04) - TD (L2GC062)" (Fall 2020, 7.5 TD hours, 3 groups; Fall 2019, 7.5 TD hours, 3 groups), Toulouse School of Management, undergraduate course (Licence 2)

"Probabilités TD (LEE2AED)" (Fall 2018, 15 TD hours, 2 groups), Toulouse School of Economics

"Advanced behavioral and experimental economics II (DUEB0309)" (Spring 2018, 6 CM hours), Toulouse School of Economics, Doctoral program DEEQA. (Segment: Social evolution theory)

"Economics and the environment for economists (M2EIGA2)" (Fall 2017, 15 CM hours), Toulouse School of Economics, Master 2 Environmental and Natural Resource Economics (ERNA), Ecology and Economics path (EEC). (Segment: Introduction to population ecology)

"Economics and evolution (DUEB0274)" (Spring 2017, 7.5 CM hours), Toulouse School of Economics, Doctoral program DEEQA. (Segment: Population and evolutionary dynamics)

"Evolutionary dynamics: Game theory (MA4454)" (Fall 2014, 8 hours), University of Lübeck, Mathematics in Medicine and the Life Sciences. (Invited lectures)

"Mathematics II (Graphs and networks)", "Mathematics IV (Complexity)" (2006–2011), University of Lausanne, Faculty of Social and Political Sciences. (Teaching assistant for Henri Volken)

"Statistics I" (2006–2011), University of Lausanne, Faculty of Social and Political Sciences. (Teaching assistant for Jean-Philippe Antonietti)

"Electronic circuits II Lab", "Automatic Control Systems Lab", "Artificial Intelligence" (2004–2005), Universidad Pontificia Bolivariana, Faculty of Electronics Engineering. Fixed-term part-time lecturer (Profesor de Cátedra)

Professional Service

Journal referee for *The American Naturalist*, *Artificial Life*, *Behavioral Ecology and Sociobiology*, *Biology & Philosophy*, *BioSystems*, *Communications Biology*, *Cognition*, *Current Opinion in Insect Science*, *Dynamic Games and Applications*, *Ecology Letters*, *Europhysics Letters*, *Evolution*, *Games*, *IEEE Access*, *IEEE Transactions on Automatic Control*, *IEEE Transactions on Evolutionary Computation*, *IEEE Transactions on Systems, Man and Cybernetics*, *Journal of Economic Behavior & Organization*, *Journal of Mathematical Biology*, *Journal of the Royal Society Interface*, *Journal of Theoretical Biology*, *Journal of Theoretical Politics*, *Management Science*, *Mathematical Biosciences*, *Mathematical Social Sciences*, *Nature Communications*, *Neural Computing & Applications*, *Oikos*, *PeerJ*, *Philosophical Transactions of the Royal Society B*, *PLOS Computational Biology*, *PLOS ONE*, *Proceedings of the National Academy of Sciences of the USA*, *Proceedings of the Royal Society B*, *Royal Society Open Science*, *Science Advances*, *Scientific Reports*, *Swarm Intelligence*, *Theoretical Population Biology*, *Theoretical Economics*

Book proposal referee for *Oxford University Press*, *Springer Nature*

Grant proposal referee for *Research Foundation – Flanders (FWO)*, *European Research Council (ERC)*

Workshop co-organizer: "The Biology and Economics of Mutualisms Workshop" at the Max Planck Institute for Evolutionary Biology (November 2017); Mini-symposium "Social Evolution in Subdivided Populations: Beyond the Usual Assumptions" at MMEE 2017; "9th Economics and Biology Workshop" at the Institute for Advanced Study in Toulouse (June 2022)

Member of the program committee at computer science conferences: ANTS (2016, 2012), ICANGA 2013, GECCO (2008–2013), CEC (2009–2011)