Curriculum Vitae of Riccardo Papa

Department of Biology; University of Puerto Rico - Rio Piedras

General information

Place and date of birth:
Citizenship:
Spoken languages: Italian (native), English (fluent), Spanish (advanced)
Written languages: Italian (native), English (fully proficient), Spanish (intermediate)

Professional Experiences and Positions

2018 – present	Professor, Department of Biology, Univ. of Puerto Rico - Rio Piedras, San Juan, PR.
2014 – 2018	Associate Professor, Department of Biology, Univ. of Puerto Rico - Rio Piedras, San Juan, PR.
2011 - present	Director of High Throughput Sequencing Center, Univ. of Puerto Rico - Rio Piedras, San Juan, PR.
2010 - 2014	Assistant Professor, Department of Biology, Univ. of Puerto Rico - Rio Piedras, San Juan, PR.
2008 - 2009	Research Assistant, Department of Ecology and Evolutionary Developmental Biology, Univ. of California, Irvine.
2007	Co-Founder of GEN-TECH s.r.l. non-profit organization for genetic food traceability and environmental consult.

Education

Post Doc. 2007 - 2008: Dept. of Ecology and Evolut. Devel. Biology, Univ. of California, Irvine *Advisor* Dr. Robert D. Reed

Post Doc. 2004 - 2007: Dept. of Biology, Univ. of Puerto Rico - Rio Piedras, San Juan *Advisor* Dr. Owen McMillan

Ph.D. 2001 - 2004: Department of Evolutionary Biology, Univ. of Parma, Italy. *Advisor* Dr. F. Nonnis

Title: "Assessment of genetic variation of migrant river fish"

Ph.D. 2002 - 2003: One year research abroad, Dept. of Animal Science, Univ. of California, Davis *Advisor* Dr. Bernie May

Title: "Spatial and temporal genetic structure of Steelhead trout populations of northern California"

B.S. 1995 - 2000 (110/110; highest achievement): Dept. of Evolutionary Biology, Univ. of Parma, Italy *Advisor* Dr. G. Gandolfi

Title: "Seasonal genetic variability of the Adriatic dwaft goby Knipowitschia panizzae".

Honors and Fellowships

2018	Smithsonian Latin America Scholarship Award
2009	Dean's Award for Postdoctoral Research Excellence, University of California, Irvine.
2007	Special expert in zoological studies, University of Parma, Department of Science.
2005	Best Italian Young Researcher in Freshwater Fish.
2004	European Social Fund Research Fellowship; one year fellowship
2003	Italian Federal Doctoral Fellowship for one year of Research Abroad at University of California, Davis
2000	National Ph.D Fellowship; three year fellowship
2000	Awarded "Best hyctiological B.S. graduation thesis", Italian Association of Freshwater Ictyologist.

Grant Support

Current

2021 – 2023.	Identity and fate of butterfly wings: from cell to color	PI	NSF OIA	$200,000
2021 – 2023.	SARS-CoV-2 genomic surveillance across the island of Puerto Rico	PI	NIH U54	$745,055
2020 – 2022	Genomic epidemiology of SARS-CoV2 and virulence association	PI	Puerto Rico Gov	$175,000
2020 – 2023	The molecular and chemical basis of butterfly's host plant choice	PI	Science Trust	$150,000
2020 – 2023	Assessing the extent and functioning of structural genome variation	PI	Science Trust	$70,000
2020 – 2023	The molecular basis of mate and host plant choice in Heliconius	PI	FIPI-UPR	$46,000
2019 – 2021	Chromatin remodeling during butterfly brain development	**Mentor**	NIH-COBRE	$150,00
2018 - 2021	Functional genetic architecture of mate choice in butterflies	**Mentor**	NSF-DBI	$207,000
2018 - 2022	The demographic and life-history consequences of re-colonizing secondary habitats	**co-PI**	NSF-DEB	$200,000
2017 - 2024	Genomic Logic Underlying Adaptive Morphological Divergence	**PI**	NSF-EPSCoR	$4,000,000
2017 - 2023	cis-Regulatory Basis of Butterfly Wing Pattern Evolution	**PI**	NSF-IOS	$383,316
2015 - 2021	Advancing competitive biomedical research in Puerto Rico	**co-PI**	NIH-INBRE	$5,753,00

Past

2018 - 2019	cis-Regulatory Basis of Butterfly Wing Pattern Evolution	**co-PI**	NSF-Suppl	$102,604
2015 - 2017	Origin and genetic population structure of the invasive green iguana.	**PI**	FIPI-UPR	$50,000
2013 - 2016	Genomic across the speciation continuum in *Heliconius* butterflies.	**co-PI**	NSF-DEB	$750,000
2011 - 2015	Identity and function of *Heliconius* mimicry genes.	**co-PI**	NSF-IOS	$550,000
2007 - 2014	Center for applied tropical ecology and conservation	**co-PI**	NSF-HRD	$5,413,122
2013 - 2014	Genomic insights into the lionfish invasion	**PI**	NSF	$99,893
2012 - 2013	Detecting gene networks underlying biodiversity	**PI**	NASA	$30,000
2011 - 2013	Assessment of invasive lionfish in Puerto Rico	**PI**	FIPI-UPR	$35,000
2004 - 2005	Developing techniques of food molecular fingerprinting	**PI**	EU-SPINNER	€35,000
2002 - 2003	Dissertation Research	**PI**	MIUR	€10,000
2000 - 2001	Genetic analysis of Italian freshwater trout	**PI**	FWS-ITA	€7,500

Publications

2021 • Santiago GA, Flores B, Gonzalez G, Charriez KN, Cora Huertas L, Volkman H, Van Belleghem S, Rivera Amill V, Adams LE, Rios EH, O'Neill E, Paz-Bailey G, **Papa R**, Munoz-Jordan JL. Genomic surveillance of SARS-CoV-2 in Puerto Rico reveals emergence of an autochthonous lineage and early detection of variants. *Nature communication* (in review)

2021 • Ogulvie J, Van Belleghem SM, Chouteau M, **Papa R**, McMillan W. O., Counterman B. Balanced polymorphisms and their divergence in a *Heliconius* butterfly. *Ecology an Evolution*. Accepted

2021 • Van Belleghem SM, Lewis JJ, Rivera ES, **Papa R**. *Heliconius* butterflies: a window into the evolution and development of diversity. *Current Opinion in Genetics and Development*: 69, 72-81

2021 • Rodriguez-Caro F., Fenner J., Bhardwaj S., Cole J., Benson C., Colombara A. M., **Papa R**, Brown M. W., Martin A., Range R. C., and Counterman B. Novel Doublesex Duplication Associated with Sexually Dimorphic Development of Dogface Butterfly Wings. *Molecular Biology and Evolution*, msab228, https://doi.org/10.1093/molbev/msab228

2021 • Livraghi L, Hanly J, Van Bellghem S., Montejo-Kovacevich G., van der Heijden E SM., Loh LS, Ren A, Warren I, Lewis JJ., Concha C, Hebberecht L., Wright C, Walker J, Foley J, Goldberg Z. H., Arenas-Castro H., Salazar C., Perry M. W., **Papa**

R., Martin A., McMillan W. O., Jiggins C. D. Cortex cis-regulatory switches establish scale colour identity and pattern diversity in Heliconius. eLife 2021;10:e68549 doi:10.7554/eLife.685492021

2021 • Van Belleghem S., Cole J. M., Montejo-Kovacevich G., Bacquet C. N., McMillan W. O, **Papa R**., Counterman B. A. Selection and isolation define a heterogeneous divergence landscape between hybridizing Heliconius butterflies. Evolution https://doi.org/10.1111/evo.14272

2020 • Rossi M, Thurman TT, Montgomery SH, Pinharanda AL, Martin SH, McMillan WO, **Papa R**, Jiggins C, Merrill RM. Behavioral genetics of visual mate preference evolution in *Heliconius* butterflies. *Nature communications*: 11 (1), 1-10

2020 • Lewis JJ, Van Belleghem SM, Papa R, Danko CG, Reed B. Many functionally linked loci foster adaptive diversification along a neotropical hybrid zone. Science advances: 6 (39), eabb8617

2020 • Van Belleghem SM, Alicea Roman P, Caria Gutierrez H, Counterman BA, **Papa R**. Perfect mimicry between *Heliconius* butterflies is constrained by genetics and development. *Proceeding of the Royal Society B* 287: 20201267 http://doi.org/10.1098/rspb.2020.1267

2020 • van Schooten B, Melendez J, Van Belleghem SM, Jiggins C, McMillan WO, **Papa R**. Divergence of chemosensing during the early stages of speciation. *PNAS*: 117 (28), 16438-16447 (Cover of PNAS issue of July)

2020 • Fenner J, Benson C, Rodriguez-Caro L, Ren A, **Papa R**, Martin A, Hoffmann F, Range R, Counterman B. Wnt genes in wing color pattern development of Coliadinae butterflies. *Frontiers in Ecology and Evolution*: 8, 197, doi:10.3389/fevo.2020.00197

2020 • Rivera-Colón AG, Westerman EL, Van Belleghem SM, Monteiro A, **Papa R**. A complex genetic architecture characterizes the hindwing eye spot number variation in *Bicyclus anynana* butterflies. *Genetics*: 10.1534/genetics.120.303059. (Cover of Genetics issue of April)

2019 • Zhang W, Leon-Ricardo BX, van Schooten B, Van Belleghem S, Counterman B, McMillan WO, Kronforst MR, **Papa R**. Comparative transcriptomics provides insights into reticulate and adaptive evolution of a butterfly radiation. *Genome Biology and Evolution*: 1;11(10):2963-2975

2019 • Concha C, Wallbank RWR, Hanly JJ, Fenner J, Livraghi L, Rivera E, Paulo D, Pardo C, Marta Vargas CA, Sanjeev M, Morrison C, Tian D, Massardo D, Counterman BA, Scott M, Jiggins CD, **Papa R***, Martin A*, and McMillan WO * (* equal contribution). Interplay between Developmental Flexibility and Determinism in the Evolution of Mimetic *Heliconius* Wing Patterns. *Current Biology*: 2;29(23):3996-4009.e4. (*Feature in The Scientist, Science Daily*)

2019 • Edelman N, Frandsen PB, Miyagi M, Clavijo B, Davey J, Dikow R, García-Accinelli G, Patterson N, Neafsey DE, Challis R, Kumar S, Moreira G, Salazar C, Chouteau M, Counterman B, Papa R, Dasmahapatra K, Kronforst M, Joron M, Jiggin C, McMillan WO, Di Palma F, Blumberg AJ, Wakeley J, Jaffe D, 2019 • Edelman N, Frandsen PB, Miyagi M, Clavijo B, Davey J, Dikow R, García-Accinelli G, Patterson N, Neafsey DE, Challis R, Kumar S, Moreira G, Salazar C, Chouteau M, Counterman B, **Papa R**, Dasmahapatra K, Kronforst M, Joron M, Jiggin C, McMillan WO, Di Palma F, Blumberg AJ, Wakeley J, Jaffe D, Mallet J. Genomic architecture and introgression shape a butterfly radiation. *Science*: 366 (6465), 594–599. (*Cover of Cover of the magazine; Feature in The Scientist*)

2019 • Lewis JJ, Geltman RC, Rondem KE, Van Belleghem SM, Hubisz M, Munn PR, Zhang L, Benson C, Mazo-Vargas A, Danko CG, Counterman BA, **Papa R,** Reed RD. Butterfly wing pattern mimicry radiated via parallel evolution of ancient, pleiotropic enhancers. *PNAS*:116 (48) 24174-24183. (*Feature in The Scientist*)

2018 • Edelman N, Frandsen PB, Miyagi M, Clavijo B, Davey J, Dikow R, García-Accinelli G, Patterson N, Neafsey DE, Challis R, Kumar S, Moreira G, Salazar C, Chouteau M, Counterman B, **Papa R**, Dasmahapatra K, Kronforst M, Joron M, Jiggin C, McMillan WO, Di Palma F, Blumberg AJ, Wakeley J, Jaffe D, Mallet J. Adaptive radiation of *Heliconius* butterflies dissected using 20 de novo genome assemblies. *bioRxiv* (doi: https://doi.org/10.1101/466292).

2018 • van Schooten B, Godoy-Vitorino F, McMillan WO, **Papa R.** Conserved microbiota among young *Heliconius* butterflies species. *PeerJ* 6:e5502; DOI 10.7717/peerj.5502

2018 • Van Belleghem SM, Baquero M, **Papa R**, Salazar C., McMillan WO, Counterman BA, Jiggins CD, Martin S. Patterns of Z chromosome divergence among *Heliconius* species highlight the importance of historical demography. *Molecular Ecology* DOI: 10.1111/mec.14560.

2018 • Van Belleghem SM, **Papa R**, Ortiz-Zuazaga H, Hendrickx F, Jiggins CD, McMillan WO, Counterman BA. Patternize: an R package for quantifying color pattern variation. *Methods in Ecology and Evolution* 00:1–9

2017 • Van Belleghem SM, Rastas P, Papanicolau A, Martin SH, Arias CF, Supple MA, Hanley JJ, Mallet J, Lewis JJ, Hines HM, Ruiz M, Salazar C, Linares M, Moreira GRP, Jiggins CD, Counterman BA, McMillan WO, **Papa R**. Complex modular architecture around a simple toolkit of wing pattern genes. *Nature Ecol. & Evol.* 1, 0052.

2016 • van Schooten B, Briscoe A, Jiggins C, **Papa R**. Genome-wide analysis of ionotropic receptors in *Heliconius* butterflies provides insight into IRs evolution. *BMC Genomics* 17 (1), 254

2015 • Supple M, **Papa R,** Hines HM, McMillan WO, Counterman BA. Divergence with gene flow across a speciation continuum of *Heliconius butterflies*. *BMC Evolutionary Biology* 15: 204.

2015 • Kronforst M, **Papa R,** The Functional Basis of Wing Patterning in *Heliconius* Butterflies: The Molecules Behind Mimicry. *Genetics* 200: 1-19.

2014 • Supple M, **Papa R,** Counterman BA, & McMillan WO. The genomics of an adaptive radiation-insights across the *Heliconius* speciation continuum. In: Ecological Genomics. C. Landry and N. Aubin-Horth (Eds.) Springer, New York

2014 • Nadeau N, Ruiz M, Salazar P, Counterman BA, Medina JA, Ortiz-Zuazaga H, Morrison A, Jiggins CD, & **Papa R.** Population genomics of parallel hybrid zones in the mimetic butteflies, *H. melpomene* and *H. erato*. *Genome Research* 24(8): 1316-1333.

2014 • Toledo-Hernández C, Vélez-Zuazo X, Ruiz-Díaz CP, Patricio AN, Mège P, Navarro M, Sabat AM, Betancur R, & **Papa R**. Population ecology and genetics of the invasive lionfish in Puerto Rico. *Aquatic Invasions,* 9(2): 222-237.

2014 • Velez-Zuazo X, Alfaro-Shigueto J, Mangel J, & **Papa R.**, Agnarsson I. What genetic barcoding reveals about the shark fishery in Peru. *Fisheries Research,* 161: 34-41.

2013 • **Papa R**, T. Hrbeck, K. Maldonado, Reed R, Nijhout HF, & McMillan WO. (2013). Multi-Allelic major effect genes interact with minor effect QTLs to control adaptive color pattern variation in *Heliconius erato*. *PLoS ONE* 8(3): e57033.

2013 • Chiesa S, Filonzi L, Vaghi M, **Papa R**, & Nonnis-Marzano F. Molecular barcoding of an atypical cyprinid population assessed by Cytochrome b gene sequencing. *Zoological Science,* 30(5): 408-13

2012 • The *Heliconius* Genome Consortium. A butterfly genome reveals promiscuous exchange of mimicry adaptations among species. *Nature*, 487: 94-98. (*Faculty of 1000; Featured in the New York Times*)

2012 • Hines HM*, **Papa R***, Mayte R, Papanicolaou A, Wang C, Nijhout FH, McMillan WO, & Reed R. Transcriptome analysis reveals novel patterning and pigmentation genes underlying *Heliconius* butterfly wing pattern variation. *BMC Genomics*, 13: 288, * equal contribution.

2012 • Martin A, **Papa R**, Nadeau N, Hill RI, Counterman BA, Halder G, Jiggins CD, Kronforst MR, LongAD, McMillan WO, Reed RD. (2012). Diversification of complex butterfly wing patterns by repeated regulatory evolution of a *Wnt* ligand. *PNAS*, 109(31): 12632-12637. (*Featured in the New York Times*)

2011 • *Reed R, ***Papa R**, Martin A, Hines HM, Counterman BA, Pardo-Diaz C, Jiggins CD, Chamberlain N, Kronforst M, Chen R, Halser G, Nijhout HF, & McMillan WO. *Heliconius* butterfly wing pattern mimicry is driven by *optix* cis-regulatory variation. *Science*, 333: 1137-1141, * equal contribution. (*Faculty of 1000; Featured in the New York Times, Washington Post, and Scientific American; Perspective article by Sean Carroll, and more*)

2011 • Hines HM, Counterman BA, **Papa R**, Alburquerque de Moura P, Cardoso MZ, Linares M, Mallet J, Reed RD, Jiggins JD, Kronfrost MR, & McMillan WO. A wing patterning gene redefines the mimetic history of *Heliconius* butterflies. *PNAS,* 108: 19666-19671. (*Cover of the magazine; Featured in the New York Times*)

2010 • Counterman BA, Araujo-Perez F, Hines HM, Baxter SW, Morrison CM, Lindstrom DP, **Papa R**, Ferguson L, Joron M, ffrench-Constant RH, Smith CP, Nielsen DM, Chen R, Jiggins CD, Reed RD, Halder G, Mallet J, & McMillan WO. Genomic hotspots for adaptation: The population genetics of Müllerian mimicry in *Heliconius erato*. *PLoS Genetics*, 6 (2): e1000796. (*Faculty of 1000*)

2008 • **Papa R**, Morrison CM, Walters JR, Counterman BA, Halder G, Ferguson L, Chamberlain N, ffrench-Constant R, Kapan DD, Jiggins CD, Reed RD, & McMillan WO. Highly conserved gene order and numerous novel repetitive elements in genomic regions linked to wing pattern variation in *Heliconius* butterflies. *BMC Genomics,* 9: 345. (*Highly Accessed Article*)

2008 • Baxter SW, **Papa R**, Chamberlain N, Humphray SJ, Joron M, ffrench-Constant RH, McMillan WO, & Jiggins CD. Parallel evolution in the genetic basis of Müllerian mimicry in *Heliconius* butterflies. *Genetics,* 180: 1567-1577.

2008 • **Papa R**, Martin A, & Reed RD. Genomic hotspots of adaptation in butterfly wing pattern evolution. *Current Opinion in Genetics and Development,* 18: 559-564.

2007 • **Papa R**, Israel J, Nonnis Marzano F, & May B. Assessment of genetic variation among reproductive ecotypes of Klamath river Steelhead reveals differentiation associated with different run timings. *Journal of Applied Ichthyology* 23: 142-146.

2007 • Nonnis Marzano F, Maldini M, Pensierini M, **Papa R**, & Gandolfi G. Marcatori molecolari e conservazione dell'ittiofauna delle acque dolci. *Biologia Ambientale,* 21(2): 67-74.

2007 • Baxter SW, Chamberlain N, **Papa R**, Humphray SJ, Ffrench-Constant RH, McMillan WO, & Jiggins CD. Identifying DNA markers close to quantitative traits in lepidoptera genomes: Using wing color variation in *Heliconius* butterfly as a model. *Journal of Insect Science,* 7(29): 1536-2442.

2007 • Joron M, **Papa R**, Mallet J, McMillan OW, & Jiggins C. Conserved but flexible: Genetic control of mimicry in *Heliconius* butterfly wing pattern. *Journal of Insect Science,* 7(29): 1536-2442.

2006 • Maldini M, Nonnis Marzano F, Fortes Gonzales G, **Papa R**, & Gandolfi G. Fish and seafood traceability based on AFLP markers: elaboration of a species database. *Aquaculture* 261: 487-494.

2006 • Kapan DD, Tobler A, **Papa R**, Reed RD, Acevedo Gonzales J, Ramirez Restrepo M, Martinez L, Maldonado K, Ritschoff C, Heckel DG, & McMillan WO. Localization of Müllerian mimicry genes on a dense linkage map of *Heliconius erato*. *Genetics*, 173(2): 735-757.

2006 • Joron M, **Papa R**, Beltrán M, Chamberlain N, Mavárez J, Baxter S, Bermingham E, Humphray S, Rogers J, Beasley H, Barlow K, ffrench-Constant R, Mallet J, McMillan, WO, & Jiggins CD. A Conserved supergene locus controls colour pattern diversity in *Heliconius* butterflies. *PLoS Biology*, 4 (10): e303. (*PLoS Primer by Axel Meyer; Featured in the Daily Telegraph, The New York Times, and more*)

2005 • **Papa R**, Troggio M, Ajmone-Marsan P, & Nonnis Marzano F. An improved protocol for the production of AFLP markers in complex genomes by means of capillary electrophoresis. *Journal of Animal Breeding and Genetics*, 122: 62-68.

2004 • Nonnis Marzano F, Tagliavini J, **Papa R**, Vaghi M, Pascale M, Maio G, & Gandolfi G. Caratterizzazione genetica di popolazioni appenniniche di trota fario: aspetti tassonomici e conservazionistici. *Biologia Ambientale,* 18: 19-24.

2003 • Razzoli M, **Papa R**, Valsecchi P, & Nonnis Marzano F. AFLP to assess genetic variation in laboratory gerbils (*Meriones unguiculatus*). *Journal of Heredity*, 94(6): 507-511.

2003 • **Papa R**, Nonnis Marzano F, Rossi V, & Gandolfi G. Genetic diversity and adaptability of two species of *Mugilidae* (Teleostei: Perciformes) of the Po river delta coastal lagoons. *Oceanologica Acta*, 26: 121-128.

2003 • Nonnis Marzano F, Corradi N, **Papa R**, Tagliavini J, & Gandolfi G. Molecular evidence for introgression and loss of genetic variability in *Salmo (trutta) macrostigma* as a result of massive restocking of Apennine populations (Northern and Central Italy). *Environmental Biology of Fishes*, 68(4): 349-356.

2001 • **Papa R**, Nonnis Marzano F, Gandolfi G, & Tagliavini J. Seasonal evolution of *Knipowitschia panizzae* (Teleostei Gobiidae) population structure as revealed by biochemical variability. *Quaderni ETP*, 30: 131-138.

2000 • Nonnis Marzano F, **Papa R**, Gandolfi G, & Tagliavini J. Variabilità genetica biochimica in popolazioni di *Knipowitschia panizzae* (Teleostei: Gobiidae) di ambienti lagunari costieri del Delta Padano. *Rivista di Idrobiologia,* 39: 107-118.

Contributed presentations

- Papa R. (2019). Genomic logic underlying morphological divergence. Pan American Evo Devo 3rd biennial meeting.

- Van Belleghem S., **Papa R**. (2019). "*Chromatin remodeling during butterfly brain development".* 3rd Drosophila neurobiology meeting. Institute of Neurobiology. San Juan, Puerto Rico.
- Van Belleghem S., **Papa R**. (2019). "*Chromatin remodeling during butterfly brain development".* 3rd Drosophila neurobiology meeting. San Juan, Puerto Rico.
- Carbia-Gutierrez H., Van Belleghem S., **Papa R**. (2019). "*Convolutional deep learning to predict physical characteristics from genomic data*". Seminario Interuniversitario de Investigación en Ciencias Matemáticas (SIDIM). Humacao, Puerto Rico.
- Rivera-Miranda T.M., Hanly J., Hermina-Perez J.J., Day C.R., **Papa R**., Martin A. (2019). *"Developmental roles of frizzled receptors in butterfly embryos"*. 38th Puerto Rico Interdisciplinary Scientific Meeting 53rd ACS Junior Technical, Mayaguez, Puerto Rico.
- Rivera-Miranda T.M., Hanly J., Hermina-Perez J.J., Day C.R., **Papa R**., Martin A. (2019). *"Developmental roles of frizzled receptors in butterfly embryos"*. Oral Presentation. Emerging Researchers National (ERN) conference in STEM, Washington, DC.
- Rivera-Miranda T.M., Hanly J., Hermina-Perez J.J., Day C.R., **Papa R**., Martin A. (2019). *"Developmental roles of frizzled receptors in butterfly embryos"*. The Biology of Genomes, Cold Spring Harbor Laboratories, New York.
- Van Belleghem S., **Papa R**. (2018). "*From populations to species: patterns of genomic divergence in Heliconius butterflies"*. 2nd Puerto Rico Drosophila Neurobiology Meeting. Puerto Rico.
- Rivera Miranda T., Hanly J., Herminia-Perez J. J., Day C. R., Martin A., **Papa R**. (2018). "Developmental role of frizzled receptors in butterfly embryos". 7th Euro EvoDevo, Ireland.
- Van Belleghem S., **Papa R**., Jiggins C., McMillan O. & Counterman B. (2018). *"Divergence at the Heliconius erato species barriers."* European Society for Evolutionary Biology.
- Van Belleghem S., **Papa R**., Jiggins C., McMillan O. & Counterman B. (2018). *"Patterns of Z chromosome divergence among Heliconius species highlight the importance of historical demography."* 51st Population Genetics Group Meeting
- Van Belleghem S., **Papa R**., Jiggins C., McMillan O. & Counterman B. (2017). "*Divergence at the Heliconius erato species boundaries*." Cambridge, UK.
- Rivera-Colon A, Ruiz M, Monteiro A, & **Papa R**. (2016). "*Genomic architecture of eyespot number variation in the butterfly Bicyclus anynana*." Louis Stokes Minority Center for Excellence (LSMCE) Meeting, Washington DC, USA.
- Van Belleghem S., McMillan O., Counterman B, & **Papa R**. (2016). "Modularity characterizes the *Heliconius* adaptive radiation." Evolution meeting, Austin, Texas, USA.
- Van Belleghem S., McMillan O., Counterman B, & **Papa R**. (2016). "*Population genomics of the Heliconius erato radiation*." University of Puerto Rico, Rio Piedras, Puerto Rico.
- Van Belleghem S., **Papa R**., McMillan O. & Counterman B. (2015). "*Population genomics of the Heliconius erato radiation*." 10th international Heliconius meeting, Gamboa, Panama.
- Van Schooten B., Jiggins C, Briscoe A., & **Papa R**. (2015). "*Evolution of ionotropic receptors in Heliconius butterflies*" Evolution, São Paulo, Brazil.
- Rivera-Colon A, Ruiz M, Monteiro A, & **Papa R**. (2015). "*Genomic architecture of eyespot number variation in the butterfly Bicyclus anynana*." Louis Stokes Minority Center for Excellence (LSMCE) Meeting, Indiana, USA.
- Rivera-Colon A, Ruiz M, Monteiro A, & **Papa R**. (2015). "*Genomic architecture of eyespot number variation in the butterfly Bicyclus anynana*." 50th Junior Technical Meeting/35th PRISM, Puerto Rico.
- Rivera-Colon A, Ruiz M, Monteiro A, & **Papa R**. (2014). "*Evolutionary genomics in the eye-spot pattern development of the butterfly Bicyclus anynana*." 49th Junior Technical Meeting/34th PRISM, Puerto Rico.
- Lester-Coll A, Velez-Zuazo X, Kelez S, Quiñones J, Alfaro-Shigueto J, Mangel JC, & **Papa R**. (2014). "*Genetic diversity, structure and likely origin of green turtles foraging off Peru*." 34th Annual Symposium on Sea Turtle Biology and Conservation, New Orleans, Louisiana.

- Rivera-Colon A, Monteiro A, Ruiz M, & **Papa R**. (2014). "*Evolutionary genomics of eye-spot pattern development in the butterfly Bicyclus anynana*." Society for Molecular Biology and Evolution (SMBE), San Juan, Puerto Rico.
- Ruiz M, Nadeau N, Ortiz-Zuazaga H, McMillan WO, Jiggins C, Counterman B, & **Papa R.** (2014). "*Genome-wide analysis of color pattern variation in Heliconius butterflies*." Society for Molecular Biology and Evolution (SMBE), San Juan, Puerto Rico.
- van Schooten B, **Papa R**, Briscoe A. (2014). "*The evolution of ionotropic receptors in Heliconius butterflies*." Society for Molecular Biology and Evolution (SMBE), San Juan, Puerto Rico.
- Velez-Zuazo X, Winkelmann I, Betancur R, Gilbert T, & **Papa R**. (2014). "*Population genomics of the lionfish (Pterois volitans) invasion in the Greater Caribbean*." Society for Molecular Biology and Evolution (SMBE), San Juan, Puerto Rico.
- Counterman B, Supple M, **Papa R**, & McMillan WO. (2014). "*Divergence with gene flow across the speciation continuum in Heliconius erato*." Society for Molecular Biology and Evolution (SMBE), San Juan, Puerto Rico.
- van Schooten B, **Papa R**, Briscoe A. (2013). "*Gene evolution of ionotropic receptors in tropical butterflies*." The 7th Annual Arthropod Genomics Symposium Notre Dame, USA.
- De Jesús C, Falcón W, & **Papa R**. (2013). "*Sourcing the green invaders: Identification of source populations of Iguana iguana in Puerto Rico*". Iguana Specialist Group (IUCN SSC). Kingstone, Jamaica.
- Nadeau N, Ruiz M, Salazar P, Counterman B, Jiggins C, & **Papa R**. (2013). Patterns of genomic divergence across parallel hybrid zones of mimetic *Heliconius* butterflies. Evolution Society for Evolutionary Biology (ESEB) Lisbon, Portugal.
- Ruiz M, Nadeau N, Counterman B, Salazar P, Medina JA, Ortiz-Zuazaga H, McMillan WO, Jiggins C, & **Papa R**. "*Population genomics of Heliconius erato and Heliconius melpomene hybrid zones*." Gordon Research Conference on Ecological & Evolutionary Genomics. Biddeford, ME.
- Ruiz M, Nadeau N, Jiggins C, & **Papa R.** (2013). "*Population genomics of hybrid zones in H. erato and H. melpomene*." Annual *Heliconius* Biology Meeting. Boston, USA.
- Leon B, Ruiz M, Ortiz H, & **Papa R**. (2012). "*Detecting patterns of natural selection in the eye transcriptomes of six Heliconius species using a 454 Next Generation Sequencing and bioinformatic approaches.*" SACNAS, Seattle, Washington. Awarded best genetic presentation.
- Zuazo-Velez X, Alfaro-Shigueto J, Mangel J, **Papa R**, & Agnarson I. (2012) "*What barcoding is revealing about the shark fishery in Peru."* World Congress of Herpetology, Vancuver, Canada.
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Press and Review Article Coverage of our Research

2021 • Opinion articles SARS-CoV-2

- ***primera hora***
  https://www.elnuevodia.com/opinion/punto-de-vista/the-complicated-path-of-covid-19-eradication/
  https://www.elnuevodia.com/opinion/punto-de-vista/mutations-are-part-of-life-the-biology-of-covid-19/

2020 • Award: Genomic epidemiology of SARS-CoV2 and virulence association

- ***primera hora***
  https://www.primerahora.com/noticias/puerto-rico/notas/profesores-de-la-upr-en-investigacion-destacada-en-prestigiosa-revista-cientifica/

2020 • van Schooten B, *et al*. Divergence of chemosensing during the early stages of speciation. PNAS: 117 (28), 16438-16447 (Cover of PNAS issue of July)

- ***el nuevo dia***
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- ***el voceru***
  https://www.elvocero.com/educacion/estudio-de-la-upr-figura-en-portada-de-prestigiosa-revista-cient-fica/article_78a4c724-d738-11ea-abf6-f79ba8fdbf8e.html
- ***primera hora***
  https://www.primerahora.com/noticias/puerto-rico/notas/profesores-de-la-upr-en-investigacion-destacada-en-prestigiosa-revista-cientifica/
- ***noticel***
  https://www.noticel.com/upr/educacion/ahora/20200805/investigacion-de-la-upr-de-rio-piedras-llega-a-la-portada-de-prestigiosa-revista-cientifica/

2019 • Concha C, *et al*. Interplay between Developmental Flexibility and Determinism in the Evolution of Mimetic *Heliconius* Wing Patterns. *Current Biology*: 2;29(23):3996-4009.e4.

- ***The scientist***
  https://www.the-scientist.com/news-opinion/gene-regulation-gives-butterflies-their-stunning-looks-66724
- ***WAPA TV***
  https://www.wapa.tv/noticias/locales/ciencia-y-meteorologia--investigacion-con-mariposas_20131122465402.html
- ***El Nuevo Dia***
  https://www.elnuevodia.com/ciencia/ciencia/nota/cientificaboricuaestudiapatrondelamariposacebra-2494569/
- ***Science daily***
  https://www.sciencedaily.com/releases/2019/11/191114115924.htm

2019 • Edelman N, *et al*. Genomic architecture and introgression shape a butterfly radiation. *Science*: 366 (6465), 594–599.

- ***Science daily***
  https://www.sciencedaily.com/releases/2019/11/191101111603.htm

2019 • NSF grants

- ***Noticia Puerto Rico TV***

- https://noticiasprtv.com/biologa-regresa-a-puerto-rico-para-estudiar-la-mariposa-cebra-en-la-upr-rio-piedras/
- https://www.elnuevodia.com/ciencia/ciencia/nota/cientificosestudiancomoloscambioseneladndelasmariposasinfluyenenelcolordesusalas-2535145/

- ***Radio Universidad***
  https://www.mixcloud.com/hoyenlasnoticias/investigación-cient%C3%ADfica-genera-millones-de-dólares-para-universidad-de-puerto-rico/
- ***El Nuevo Dia***
  https://www.elnuevodia.com/ciencia/ciencia/nota/asignan4millonesalauprparainvestigacionsobregenes-2397505/
- ***Eureka alert AAAS***
  https://www.eurekalert.org/pub_releases/2017-08/nsf-nea080317.php
- ***Riccardo Papa, UPR-RP ganan subvención de $4 millones***
  http://www.uprrp.edu/?p=15494
- ***You Tube Investigadores de la UPR-RP ganan subvención de $4 millones***
  https://www.youtube.com/watch?v=4AshZcTF8Rg
- ***Jennifer Gonzalez web page***
  https://gonzalez-colon.house.gov/media/press-releases/jenniffer-gonz-lez-anuncia-47-millones-en-fondos-federales-para-investigaciones

2017 • Van Belleghem SM, *et al.* Complex modular architecture around a simple toolkit of wing pattern genes. *Nature Ecol. & Evol.* 1, 0052.

- ***The molecular Ecologist*** - That's an *H. erato* of a different color!
  http://www.molecularecologist.com/2017/02/thats-an-h-erato-of-a-different-color/
- ***UPR, RP noticias*** - Investigación de la UPR-RP destaca cambios morfológicos en las mariposas
  http://www.uprrp.edu/?p=13863
- ***Nature*** - Unrevealing the complex evolution of color pattern
  https://natureecoevocommunity.nature.com/users/27528-steven-van-belleghem/posts/14443-towards-unraveling-the-complex-evolution-of-color-patterns

2015 • Kronforst M, Papa R, The Functional Basis of Wing Patterning in *Heliconius* Butterflies: The Molecules Behind Mimicry. *Genetics* 200: 1-19.

- ***Genes to Genomes*** - "The-molecules-behind-mimicry"
  http://genestogenomes.org/the-molecules-behind-mimicry/

2012 • The *Heliconius* Genome Consortium. A butterfly genome reveals promiscuous exchange of mimicry adaptations among species. *Nature*, 487: 94-98.

- ***Sciene Daily*** - "Genome research reveals key behind one butterfly's ability to mimic another".
  http://www.sciencedaily.com/releases/2012/05/120516135502.htm
- ***Faculty of 1000*** by Patrik Nosil and Laurent Keller.
  http://f1000.com/prime/717147891
- ***The New York Times*** (USA) by Sean B. Carroll - "Solving the Puzzles of Mimicry in Nature".
  http://www.nytimes.com/2013/03/12/science/solving-the-puzzles-of-mimicry-in-nature.html?pagewanted=all

2011 • Hines HM., *et al.* A wing patterning gene redefines the mimetic history of *Heliconius* butterflies. *PNAS,* 108: 19666-19671.

- ***The New York Times*** (USA) by Sean B. Carroll - "Solving the Puzzles of Mimicry in Nature".

http://www.nytimes.com/2013/03/12/science/solving-the-puzzles-of-mimicry-in-nature.html?pagewanted=all

- ***Sciene Daily -*** "Evolutionary geneticist helps to find butterfly gene, clue to age-old question". http://www.sciencedaily.com/releases/2012/01/120131092455.htm

2011 • *Reed R, ***Papa R**, *et al*. *Heliconius* butterfly wing pattern mimicry is driven by *optix* cis-regulatory variation. *Science*, 333: 1137-1141, * equal contribution.

- ***The New York Times*** (USA) by Sean B. Carroll - "Solving the Puzzles of Mimicry in Nature". http://www.nytimes.com/2013/03/12/science/solving-the-puzzles-of-mimicry-in-nature.html?pagewanted=all
- ***El Nuevo Dia*** (Puerto Rico) - "Professor boricua en la UPR ayuda a resolver misterio cientifico centenario". http://www.elnuevodia.com/nota-1060751.html
- ***Science Daily*** - "Butterfly vision, wing color linked". http://www.sciencedaily.com/releases/2010/02/100216140301.htm
- ***Science Daily*** - "Eye gene colors butterly wings red". http://www.sciencedaily.com/releases/2011/07/110721172338.htm
- ***Yahoo News*** - "Gene involved in eye development in organisms gives butterfly wings red colour". https://in.news.yahoo.com/gene-involved-eye-development-organisms-gives-butterfly-wings-141323762.html
- ***Cosmos*** - "Biologists identify butterfly copycat gene". http://cosmosmagazine.com/news/single-gene-tied-butterfly-mimicry/
- ***Perspective article in Science*** by Carroll S.B. (2011). How great wings can look alike. *Science Perspective*, 333: 1100-1101.
- ***Bioessays*** by Monteiro A. (2012). Gene regulatory networks reused to build novel traits: co-option of an eye-related gene regulatory network in eye-like organs and red wing patches on insect wings is suggested by optix expression. *Bioessays*, 34(3): 181-186.

2010 • Counterman BA, *et al*. Genomic hotspots for adaptation: The population genetics of Müllerian mimicry in *Heliconius erato*. *PLoS Genetics*, 6 (2): e1000796.

- ***The Telegraph*** (UK) by Stephen Adams - "Genes that give butterflies identical wings found**".** http://www.telegraph.co.uk/science/science-news/7189179/Genes-that-give-butterflies-identical-wings-found.html
- ***Science Daily*** - "How butterfly got their spot". http://www.sciencedaily.com/releases/2010/02/100205213102.htm
- ***PLos Genetics Perspective*** by Martin A., Kapan D.K., Gilbert L.E. (2010). Wing Pattern in the Mist. *PLos Genetics Perspective* 6(2): e1000822. doi:10.1371/journal.pgen.1000822
- ***Faculty of 1000*** by Elain Ostrander. http://f1000.com/prime/2456972

2006 • Joron M, ***et al***. A Conserved Supergene Locus Controls Colour Pattern Diversity in *Heliconius* Butterflies. *PLoS Biology*, 4 (10): e303.

- ***The New York Times*** by Carol Kasesuk Yoon - "From a Few Genes, Life's Myriad Shapes". http://www.nytimes.com/2007/06/26/science/26devo.html?pagewanted=all
- ***El País*** (Spain) by Javier Sampedro - "La evolucíon de la belleza". http://elpais.com/diario/2006/10/15/sociedad/1160863202_850215.html
- ***G1-Globo*** (Brazil) by by Marília Juste - "Supergene dá cores diferentes a asas para proteger borboletas. http://g1.globo.com/Noticias/Ciencia/0,,AA1285939-5603-141,00.html
- ***Daily Telegraph*** (UK) by by Roger Highfield - "Supergene that paints butterflies is pinpointed".

- ***Sciene Daily*** - "How butterflies got their spots: a supergene controls wing pattern diversity". http://www.sciencedaily.com/releases/2010/02/100216140301.htm
- ***Nature Review Genetics*** by Skipper M. (2006). Converge and diversify. *Nature Review Genetics,* 7: 828, doi:10.1038/nrg2001

Seminars, Symposia and Invited Talks

Invited Speaker	University of Puerto Rico, Aguadilla	March 2021
	"A lesson from butterflies: evolution and development of biological diversity"	
Invited Speaker	University of Ana G. Méndez, Puerto Rico	February 2021
	"A lesson from butterflies: evolution and development of biological diversity"	
Invited Speaker	University of Puerto Rico, Arecibo	February 2021
	"A lesson from butterflies: evolution and development of biological diversity"	
Invited Speaker	University of Turabo, Puerto Rico	February 2021
	"A lesson from butterflies: evolution and development of biological diversity"	
Invited Speaker	University of California, Davis	February 2020
	"A butterfly's tale: a lot more than just a pair of pretty wings"	
Invited Speaker	University of Ferrara, Ferrara (Italy)	July 2019
	"The genomic targets of natural selection in butterflies wing color pattern evolution"	
Invited Speaker	University of Bologna, Bologna (Italy)	July 2019
	"Genome to phenome of butterfly's wing color pattern variation"	
Invited Speaker	George Washington University, Washington DC (USA)	April 2019
	"Genomic Logic Underlying Morphological Divergence"	
Invited Speaker	University of Puerto Rico, Humacao, (Puerto Rico)	July 2018
	"It's a kind of magic: genetic tricks to color a butterfly's wing"	
Invited Speaker	University of Puerto Rico, Institute of Neurobiology, (Puerto Rico)	July 2018
	"The genomic recipe to color a butterfly's wing"	
Invited Speaker	University of Puerto Rico, Bayamon (Puerto Rico)	May 2018
	"The genomic recipe to color a butterfly's wing"	
Invited Speaker	University of California Berkeley	December 2017
	"The Butterfly Effect"	
Invited Speaker	University of Puerto Rico, Medical campus (Puerto Rico)	June 2017
	"Complex cis-regulatory architecture and modularity are key features in adaptive radiations."	
Invited Speaker	University of Puerto Rico, Institute of Neurobiology, (Puerto Rico)	June 2017
	"Complex cis-regulatory architecture and modularity promte adaptive radiations"	
Invited Speaker	Interamerican University, Barranquitas (Puerto Rico)	February 2016
	"Modularity characterizes the Heliconius adaptive radiation"	
Invited Speaker	University of Parma (Italy)	June 2016
	"Cis-regulatory evolution drive butterfly wing pattern variation"	
Invited Speaker	American Chemical Society (Puerto Rico)	November 2015
	"The genomic revolution"	
Invited Speaker	University of Puerto Rico, Rio Piedras	July 2014
	"International Heliconius butterflies meeting"	
Invited Faculty	North Carolina State University	July 2014
	"Genomics insight into the evolution of tropical mimetic butterflies".	
Invited Faculty	University of Puerto Rico, Humacao (NIH-MARC)	February 2014
	"New insight into the Heliconius butterfly genome through the lens of evolution".	
Invited Faculty	University of California, Berkeley	September 2013

	"Dissecting a complex trait: a butterfly wing color pattern"	
Invited Faculty	Boston University	October 2012
	"Genetic developmental mechanisms underlying Heliconius wing color patterns"	
Invited Faculty	University of Puerto Rico, Rio Piedras (NIH-RISE)	February 2012
	"Genetic tools to paint a butterfly's wing"	
Invited Speaker	Entomological Society of America (ESA)	March 2011
	"Genetic tools to paint a butterfly's wing"	
Departmental Seminar	Entomological Society of America (ESA)	March 2011
	"Evolution and genetics of mimicry in tropical butterflies"	
Departmental Seminar	University of Puerto Rico, Rio Piedras	April 2011
	"Genetic architecture of Heliconius wing color patterns"	
Departmental Seminar	University of Puerto Rico, Rio Piedras (NIH-RISE)	January 2011
	"How nature makes a butterfly's wing color pattern?"	
Departmental Seminar	University of California, Irvine	February 2009
	"Gene show their colors: wing pattern in Heliconius butterflies"	
Departmental Seminar	University of Puerto Rico, Rio Piedras	April 2007
	"Heliconius butterflies: natural selection, adaptation and evolution "	
Departmental Seminar	University of Parma (ITALY)	June 2007
	"Genomic hotspot of butterflies adaptation"	
Invited Speaker	International Conference on the Biology of Butterflies	July 2007
	"Genetics architecture of the Heliconius erato adaptive radiation"	
Invited Speaker	University of Parma (ITALY)	February 2006
	"Heliconius butterflies as a model system to study evolution"	
Departmental Seminar	University of Roma, La Sapienza (ITALY)	February 2005
	"Genes involved in the Müllerian mimetism of Heliconius butterflies"	
Invited Speaker	University of Parma (ITALY)	March 2002
	"Genetic diversity in resident fish population of the delta Po river coastal lagoons"	

Public and University Service

National and International

2014	Symposia organizer for the Society for Molecular Biology and Evolution (SMBE): *"Genomics of adaptation"*
2014	Organizer of the *"Annual International Heliconius butterflies meeting"*
2009-present	Reviewers of numerous national and international manuscripts and grant proposals
2009-present	Member of the International *Heliconius* Genome Consortium

University of Puerto Rico

2013-present	Active Member of the Minority Graduate Students NSF-MARC Program
2011-present	Active Member of the NIH-INBRE Program
2011-present	Active Member of the Minority Undergraduate Students NIH-RISE Program

Department of Biology, University of Puerto Rico

2013	Recruitment Committee for a Faculty in Population Genetics
2013	Recruitment Committee for a Faculty in Systematics
2013	Recruitment Committee for a Faculty in Ecology
2011-2017	Committee Member of Academic Affairs
2011-present	Director of the Sequencing Genomic Facility
2011-present	Organizer of several workshops on Next Generation Sequencing applications (at least twice a year)

2018-present	Committee Member Communication and departmental page

Public Outreach

2018	science day at the UPR with 4 Highschool of San Juan (Genome to Phenome)
2014-2015	Hosted high school teachers for a summer research project
2012-2013	Hosted minority high school student researchers
2011-2013	Several public science lectures to general audiences