

Eladio J. Márquez

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Current Appointment

Associate Research Scientist – Computational Genomics, The Jackson Laboratory for Genomic Medicine (2014-present)

Supervisor: Dr. Duygu Ucar

Past Appointments

- **Postdoctoral Associate** – Dr. David Houle’s Evolutionary Genetics Laboratory, Dept. Biological Science, Florida State University, Tallahassee, FL (2009-2014)
- **Graduate Student Research Assistant** – Insects Division, University of Michigan Museum of Zoology, Ann Arbor, MI (2005-2009)
- **Graduate Student Research Assistant** – Dr. L. Lacey Knowles’ Laboratory, University of Michigan Dept. of Ecology and Evolutionary Biology, Ann Arbor, MI (2003-2005).
- **Graduate Student Research Assistant** – Mammals Division, University of Michigan Museum of Zoology, Ann Arbor, MI (2002-2003).
- **Lecturer Professor** (*tenure-track*) – Department of Environmental Studies, Universidad Simon Bolivar, Caracas, Venezuela (1998-2000).
- **Biologist I** – Environmental Impact Studies Division, General Direction of Environmental Quality, Venezuelan Ministry for the Environment and Renewable Natural Resources (MARNR), Caracas, Venezuela (1997-1998).
- **Statistical consultant** – HIDROMET Engineering Consultants and CONOCO Oil Co., Caracas, Venezuela (1997). Author of the report “Statistical Design for a Baseline for Environmental Assessment of the Project for Oil Production of the West Paria Gulf.”
- **Research Assistant** – Dr. Marisol Aguilera’s Laboratory, Universidad Simon Bolivar, Caracas, Venezuela (1996-1997)
- **Curatorial Assistant** – Natural Science Museum, Universidad Simon Bolivar, Caracas, Venezuela (1993).

Education

- **Ph.D. in Biology** (2009), University of Michigan, Ann Arbor, MI
Dissertation: A general framework for inferring the developmental causes of modularity of morphological variation with applications to the craniomandibular complex in rodents
Advisors: Dr. Miriam L. Zelditch and Dr. Philip Myers
- **Licentiate in Biology** (1997), Universidad Simon Bolivar, Caracas, Venezuela.
Thesis: Cranial morphometrics in the *Oryzomys albigularis* Complex (Rodentia: Sigmodontinae)
Advisor: Dr. Marisol Aguilera

Publications

- **Márquez, E. J.**, D. Houle. Dimensionality and the statistical power of multivariate genome-wide association studies. *In review*.
- **Márquez, E. J.**, R. Cabeen, R. Woods, D. Houle. 2012. The measurement of local variation in shape. *Evolutionary Biology* 39:419-439.
- Stinchcombe, J. R., J. Beder, P. A. Carter, G. W. Gilchrist, D. Gervini, R. Gomulkiewicz, B. Hallgrímsson, N. Heckman, D. Houle, J. G. Kingsolver, **E. Márquez**, J. Marron, K. Meyer, W. Mio, J. Schmitt, F. Yao, M. Kirkpatrick. 2012. Genetics and evolution of function-valued traits: understanding environmentally responsive phenotypes. *Trends in Ecology and Evolution* 27:637-647.
- Parsons, K. J., **E. Márquez**, C. Albertson. 2012. Constraint and opportunity: the genetic basis and evolution of modularity in the cichlid mandible. *American Naturalist* 179:64-78.
- Knowles L. L., T. M. Chappell, **E. J. Márquez**. Concordance of hybrid clines reveals sexual selection's role in genitalic divergence and speciation. *In review*.
- **Márquez, E. J.** 2008. A statistical framework for testing modularity in multidimensional data. *Evolution* 62:2688-2708.
- **Márquez, E. J.**; Knowles, LL. 2007. Correlated evolution of multivariate traits: detecting co-divergence across multiple dimensions. *Journal of Evolutionary Biology* 20:2334-2348.
- **Márquez, E. J.**, M. Aguilera, M. Corti. 2000. Morphometric and chromosomal variation in populations of *Oryzomys albigularis* (Muridae: Sigmodontinae) from Venezuela: multivariate aspects. *Zeitschrift für Saugetierkunde* 65:84-99.

Publicly available software

- **Marquez, E. J.** 2013. CPR: Utility for processing *Drosophila* wing morphometric data produced through Dr. Houle's lab WINGMACHINE system. Florida State University, <http://bio.fsu.edu/~dhoule/Software/Wings>

- **Márquez, E. J.** 2012. LORY: Model-based estimation of local shape deformations. Florida State University, <http://www-personal.umich.edu/~emarquez/morph>
- **Márquez, E. J.** 2011. SIFT: Tool for filtering genomewide scan data based on frequencies of resolved and unresolved sites, Florida State University, <http://www-personal.umich.edu/~emarquez/morph>
- **Márquez, E. J.** 2011. WINNOW: Tool for mapping of multivariate phenotypic data on genomewide scans, Florida State University, <http://www-personal.umich.edu/~emarquez/morph>
- **Márquez, E. J.** 2011. flyWISH: Drosophila wing shape artificial selection utility. Florida State University, <http://www-personal.umich.edu/~emarquez/morph>
- **Márquez, E. J.** 2008. MINT: Modularity and Integration analysis tool for morphometric data. University of Michigan, <http://www-personal.umich.edu/~emarquez/morph>
- **Márquez, E. J.** 2007. CORIANDIS: Correlation Analysis based on Distances. University of Michigan, <http://www-personal.umich.edu/~emarquez/morph>
- **Márquez, E. J.** 2006. SemiThinner: utility to convert curves in semi-landmarks. University of Michigan, <http://www-personal.umich.edu/~emarquez/morph>
- **Márquez, E. J.** 2006. MACE3D: Matrix correlation for 3-D landmark data. University of Michigan, <http://www-personal.umich.edu/~emarquez/morph>
- **Márquez, E. J.** 2005. SAGE: Symmetry and Asymmetry in Geometric Data. University of Michigan, <http://www-personal.umich.edu/~emarquez/morph>
- **Márquez, E. J.** 2005. MACE: Matrix correlation for landmark data. University of Michigan, <http://www-personal.umich.edu/~emarquez/morph>

Grants

- **Building, understanding and applying a dictionary of genetic effects**, National Institutes of Health R01 GM094424. 2010-2014. \$1,594,731. PIs: Dr. David Houle, Dr. Ian Dworkin.
- **The dictionary of genetic effects and the language of morphology**, National Science Foundation DEB-0950002. 2010-2014. \$ \$688,197. PIs: Dr. David Houle, Dr. Eladio Márquez.
- **Phylogenetic persistence of modularity of the rodent skull**, National Science Foundation DDIG 0407570. 2004. \$11,995. PIs: Dr. Miriam Zelditch, Eladio Márquez.
- **Hinsdale Fellowship**, University of Michigan Museum of Zoology. 2004. \$1,870.
- **Assessing developmental constraints: isolating the developmental and adaptive components of covariance patterns**, Society for Integrative and Comparative Biology, Fellowship of Graduate Student Travel. 2003. \$2,000.
- **Fellowship to support Undergraduate thesis**. Department of Professional Studies, Universidad Simon Bolivar, Venezuela. 1996. Bs. 100,000 (approx. \$340 at 1996 exchange rate).

Research Groups and Training

- **Working Group: Cross-Topology Registration**, National Institute for Mathematical and Biological Synthesis (NIMBioS), University of Tennessee, Knoxville, TN, 2010-2013 (http://www.nimbios.org/workinggroups/WG_ct_registration).
- **Summer School, Symposium, and Workshop on Geometric Morphometrics (MorphoFest)**, Department of Anthropology, University of Vienna, Austria, 2006.
- **Workshop on basics of web page design**, Direction for Professorial Development, Universidad Simon Bolivar, Caracas, Venezuela, 1999.
- **Workshop on Teaching Methodology**, Direction for Professorial Development, Universidad Simon Bolivar, Caracas, Venezuela, 1998.
- **Workshop on Environmental Impact**, Universidad Simon Bolivar, Caracas, Venezuela, 1997.

Presentations

Invited presentations

- **The dictionary of genetic effects: Searching for causation in the phenotype of genes.** 2012. Florida State University FlyMasters forum, Tallahassee, FL.
- **Canalization and developmental stability of the rodent skull.** 2004. Symposium: Mechanistic Approaches to Evolutionary Developmental Biology, VII International Congress of Vertebrate Morphology, Boca Raton, FL. [Journal of Morphology 240:342 (2005)]

Contributed Presentations (selected)

- **Márquez, E. J.**, R. A. Moscarella, D. Aponte, W. Mio, D. Houle. 2013. A Dictionary of Genetic Effects as a Unified Representation of the Genotype-Phenotype Map. Annual Drosophila Research Conference, Washington, DC.
- **Márquez, E. J.**, D. Houle. 2011. Testing hypotheses about single-gene effects in genome-wide functional genomic studies. Meeting of the European Society of Evolutionary Biologists. Tubingen, Germany.
- **Márquez, E. J.**, R. Cabeen, R. Woods, D. Houle. 2010. Incorporating Biological Models into Morphometrics. Joint annual meeting of the American Society of Naturalists, Society of Systematic Biologists, and Society for the Study of Evolution in Portland, OR.
- **Márquez, E. J.** 2010. The shape of things to come: Toward a predictive framework for phenotypic evolution. Department of Biological Science, Florida State University.
- **Márquez, E. J.** 2008. Can Modular Variation Affect Patterns of Morphological Disparity in the Rodent Mandible? Meeting of the Society for Comparative and Integrative Biology, San Antonio, TX.

- **Márquez, E. J.** 2007. Do patterns of correlated divergence resemble intraspecific patterns of covariation? A study of skull evolution in a clade of ecologically diverse rodents. VIII International Congress of Vertebrate Morphology, Paris, France.
- **Márquez, E. J.** 2006. Intra- and Interspecific Patterns of Morphological Integration in a Clade of Sigmodontine Rodents. Joint annual meeting of the American Society of Naturalists, Society of Systematic Biologists, and Society for the Study of Evolution in Stony Brook, NY.
- **Márquez, E. J., L. L. Knowles.** 2006. Accelerated divergence of co-evolving sexual-selected traits during species diversification. Joint annual meeting of the American Society of Naturalists, Society of Systematic Biologists, and Society for the Study of Evolution in Stony Brook, NY.
- **Márquez, E. J., L. L. Knowles.** 2005. Links between sexually selected genitalic divergence and rates of speciation in montane grasshoppers. Joint annual meeting of the American Society of Naturalists, Society of Systematic Biologists, & Society for the Study of Evolution, Fairbanks, AK
- **Márquez, E. J.** 2005. Inferring patterns of morphological integration and modularity using morphometrics. Joint annual meeting of the American Society of Naturalists, Society of Systematic Biologists, & Society for the Study of Evolution, Fairbanks, AK
- **Márquez, E. J., M. L. Zelditch.** 2005. Spatiotemporal dynamics of canalization and developmental stability in the mouse skull. Meeting of the Society for Comparative and Integrative Biology, San Diego, CA.
- **Márquez, E. J., M. Aguilera.** 2000. Evolution of patterns of phenotypic covariance of cranial characters in *Oryzomys albigularis* (Muridae, Sigmodontinae) karyomorphs. IX Iberoamerican Congress of Biodiversity and Vertebrate Zoology, Buenos Aires, Argentina.
- **Márquez, E. J. et al.** 1998. General methodology for the assessment of environmental impacts on fauna and its application to the Ordering Plan of the Imataca Forest Reserve, Bolivar State. VI Seminar on Environmental Conservation of Guayana. Ciudad Guayana, Venezuela.

Teaching & Mentoring Experience

As a Postdoctoral Associate at Florida State University, Tallahassee, Florida (2009-2014):

- Co-mentoring of graduate student: David Aponte.
- Co-mentoring of undergraduate students: Christine Bruha, Allison Heath, Jane-Elyse Henkel, Kayli Kishel, Kirill Kornushov, Dan Lam, and Taylor Paisie.
- Advanced Evolutionary Biology (PCB5675) – Invited lecture: How do genetic covariances structure phenotypic evolution? (Nov. 2012).
- Advanced Evolutionary Biology (PCB5675) – Invited lecture: Programming in MATLAB (Sep. 2010).
- Workshop: Geometric Morphometrics Primer – Dr. David Houle’s Laboratory, Florida State University, Tallahassee (May 2010).

As Graduate Student Instructor at University of Michigan, Ann Arbor, MI (2002-2006):

- Introductory Biology (BIO162).
- Introductory Biology: Ecology and Evolution (BIO171).
- Animal Diversity (BIO108).
- Co-mentoring of graduate student: Thomas Chappel.

As Lecturer Professor at Universidad Simon Bolivar, Caracas, Venezuela (1998-2000):

- Animal Biology II Laboratory (EA2381).
- Population Biology and Evolution Laboratory (EA2181).
- Management and Conservation of Terrestrial Ecosystems (EAD213).

As an undergraduate student teaching assistant (1990-1997):

- General Genetics Laboratory (BC3281).
- Population Biology and Evolution Laboratory (EA2181).
- Plant Biology Laboratory (BO2211).
- Summer School Biology.

Honors and Awards

- Fellowship to support Ph.D. studies at University of Michigan granted by the Direction for Professorial Development, Universidad Simon Bolivar, Caracas, Venezuela (2000-2002).
- Educational Credit for Ph.D. studies from Gran Mariscal de Ayacucho Foundation, Caracas, Venezuela (2000).
- Honorable mention for undergraduate thesis, Universidad Simon Bolivar, Caracas, Venezuela (1997).
- Scholarship for undergraduate studies from Gran Mariscal de Ayacucho Foundation, Caracas, Venezuela (1993).

Professional service

Journal reviewer

Biological Journal of the Linnean Society, Evolution, Evolutionary Biology, Lethaia, Journal of Anatomy, Journal of Experimental Zoology, Journal of Heredity, Journal of Zoology, Mammalian Biology, PLoS ONE.

Research funding review panels

Biotechnology and Biological Sciences Research Council (UK), Deutsches Pflanzen Phenotypisierung Netzwerk (Germany).

Academic websites

- Website for public distribution of authored software and accompanying user guides for morphometrics data analysis and other tools (2003-2014). URL: <http://www-personal.umich.edu/~emarquez/morph>. Site has received over 12,600 visits since its

inception and currently receives approx. 45 visits per week. In addition, the site functions as a portal to provide technical support and establish communication with students of morphometrics worldwide.

- Website in Spanish language in support of the course “Population Biology and Evolution (EA2181)” at Universidad Simon Bolivar, Venezuela (2000). URL: <http://prof.usb.ve/ejmarque/cursos>. This site, which remains online, was among the first to provide full teaching support for a course in Venezuela. During the traffic measurement period 2003-2008, the site received over 3,300 visits from across the Hispanic world.

Membership in Academic Societies

Society for Integrative and Comparative Biology, Society for the Study of Evolution, European Society of Evolutionary Biologists, Genetics Society of America

Areas of Expertise

Bioinformatics, the genotype-phenotype map, high-dimensional biological data, phenomics, multivariate statistics, statistical shape analysis, non-Euclidean spaces, modularity, morphological integration, developmental stability, quantitative genetics, genome-wide association studies, functional genomics, phenotypic plasticity, resampling methods, interpolation, function-valued traits, correlation metrics in multidimensional spaces, experimental design, algorithm development, programming, basic web design.

Special Interests

Topology, computer vision, machine learning, theory of causation, facial expressions of emotion, non-verbal communication and social interactions, evolutionary medicine, manifold learning, cross-topology mapping.