

Marco Arieli Herrera-Valdez

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Education

University of Arizona

Ph.D. Mathematics (2014), **Ph.D.** Physiological Sciences (2008)
M.Sc. Mathematics (2002)

National Autonomous University of Mexico

Lic. Actuarial Sciences (1997)

Academic positions

National Autonomous University of Mexico

Associate professor, Facultad de Ciencias, (August 1, 2015-presente). *Postdoctoral researcher*, Mathematics Institute (IM, August, 2014-July 2015). *Investigador visitante*, IM (June 2012-August, 2012; February, 2013-April, 2013).

University of Puerto Rico in Cayey

Assistant Professor, Mathematics and Physics Department, Institute for Interdisciplinary Research (2011-2012).

Arizona State University

Assistant Research Professor in Complex Adaptive Systems (2010-2011). *Assistant Research Professor*, Mathematical, Computational, and Modeling Sciences Center (MCMSC), School of Mathematical and Statistical Sciences (SMSS) y School of Life Sciences (2009-2010). *Postdoctoral Researcher*, SMSS & MCMSC (2008-2009).

University of Arizona

Associate Professor, Evelyn F. McKnight Brain Institute (2009-present).

Resume

- *Education.* Doctoral training in *mathematics* (probability and stochastic processes, dynamical systems) and *physiology* (cellular biophysics, experimental neurophysiology). Postdoctoral training in computational biology, neurosciences, and exercise biophysics.
- *Teaching and academic mentorship.* Imparted undergraduate and graduate courses in mathematics, biophysics, physiology. During the last 3 years have advised 4 students in their thesis work (3 masters, 1 undergraduate) and participated in doctoral committees for 2 students. Previous experience includes mentoring at least 25 undergraduate students in research projects with high mathematical content. In 2011-2012, was co-founder of the first undergraduate research program in Mathematics and Sciences at University of Puerto Rico in Cayey (scienceandmathgrp.wordpress.com).
- *Research interests:* *General principles underlying function and interactions between systems at different levels of biological organization.* Biophysics, nonlinear dynamics, and excitability. Non autonomous dynamical systems. Complex adaptive systems in (neuro)biology.
- *Publications.* Autor of 9 peer-reviewed scientific articles (3 in review), 3 book chapters, and at least 19 conference abstracts of which at least 10 were peer reviewed.
- *Awards and funding.* Member of the Mexican National System of Researchers (SNI, level 1, CONACyT, México) since January, 2015. Principal co-investigator (i) Mathematical, Theoretical, and Biological Institute (NSA-funded summer research program) y (ii) NSF-funded conference for students in STEM programs.
- *Consulting.* (i) Modeling fluid dynamics in porous media for oil research; (ii) Financial planning, logistics, and integration of technology for industry; (iii) Mitigation of infectious diseases.

Research

Areas of interest: *Interactions between different elements of systems at different levels of biological organization. Biophysical principles underlying the activity of networks in physiological systems.* Nonlinear dynamics in networks. Bifurcations and attractivity in non-autonomous dynamical systems (deterministic and random).

Current projects (1) Cellular biophysics underlying the dynamics in brain microcircuits. (2) Sequences of bifurcations induced by random perturbations in excitable systems. (3) Excitability in transcription regulation.

Areas of applicability: *Neurophysiology* of motor control, learning, and memory. Relationship between patterns of gene expression, phenotypical diversity, and cellular biophysics.

Collaborators: José Bargas and Elvira Galarraga (IFC-UNAM); Fernando Baltazar Larios, Miguel Lara Aparicio, Alessio Franci, Erin C. McKiernan (FC-UNAM); Ayari Fuentes Hernández and Rafael Peña-Miller (CCG-UNAM); José Ramos Castañeda (INSP), Diano F. Marrone (Wilfrid Laurer University).

Publications

Peer-reviewed articles (*student, **postdoc)

1. Falcón-Lezama J.A.; Santos-Luna R.; Roman-Perez S.; Martínez-Vega R.A., *Herrera-Valdez MA*, Kuri-Morales A.F.; Adams B.; Kuri-Morales P.A.; Lopez-Cervantes M.; Ramos-Castañeda J. (2017). Analysis of spatial mobility in subjects from a Dengue endemic urban locality in Morelos State, Mexico, *PLoS ONE* 12(2): e0172313. doi: 10.1371/journal.pone.0172313.
2. Barroso-Flores J., *Herrera-Valdez MA*, Lopez-Huerta V.G., Galarraga E., Bargas J. (2015). Diverse short-term dynamics of inhibitory synapses converging on striatal projection neurons: differential changes in a rodent model of Parkinson's disease. *Neural Plasticity, "Plasticity of the GABAergic System in Physiology and Disease"*, Hindawi, 2015. doi: 10.1155/2015/573543
3. *Herrera-Valdez MA*, Suslov S.K., *Vega-Guzmán J. (2014) A Graphical Approach to a Model of a Neuronal Tree with a Variable Diameter. *Mathematics*, 2(3):119-135, ISSN: 2227-7390, doi: 10.3390/Math2030119
4. *Herrera-Valdez MA*, **McKiernan E.C., *Berger, S.D, Ryglewski S., Duch C., Crook S. (2013) Relating ion channel expression, bifurcation structure, and diverse firing patterns in a model of an identified motor neuron. *Journal of Computational Neuroscience*, 34(2): 211-229, ISSN: 1573-6873, doi: 10.1007/s10827-012-0416-6.
5. Strube-Bloss M.F., *Herrera-Valdez MA*, Smith B.H. (2012) Ensemble Response in Mushroom Body Output Neurons of the Honey Bee Outpaces Spatiotemporal Odor Processing Two Synapses Earlier in the Antennal Lobe. *PLoS ONE*, 7(11): e50322. EISSN-1932-6203, doi:10.1371/journal.pone.0050322
6. *Herrera-Valdez MA* (2012) Membranes with the same complements of ion channels but different excitabilities. *PLoS ONE*, 7(4): e34636. DOI:10.1371/journal.pone.0034636. EISSN-1932-6203, doi:10.1371/journal.pone.0034636
7. *Cruz-Aponte M., **McKiernan E.C., *Herrera-Valdez MA* (2011) Mitigating effects of vaccination on influenza outbreaks given constraints in stockpile size and daily administration capacity. *BMC Infectious Diseases*, 11:207, ISSN: 1471-2334, doi: 10.1186/1471-2334-11-207
8. *Herrera-Valdez MA*, *Cruz-Aponte M., Castillo-Chávez C. (2011) Multiple outbreaks for the same pandemic: Local transportation and social distancing explain the different "waves" of AH1N1PDM cases observed in México during 2009. *BME*, 8(1):21-48, ISSN 1551-0018, doi:10.3934/mbe.2011.8.21
9. *Herrera-Valdez MA* and Lega J. (2010) A reduced model for the pacemaker dynamics of cardiac cells. *J. Theoretical Biology*, Feb 7;270(1):164-76, ISSN: 0022-5193, doi:10.1016/j.jtbi.2010.09.042

Book chapters

1. Barroso-Flores J., *Herrera-Valdez MA*, Galarraga E., Bargas J. (2017). Models of short term synaptic plasticity. *Brain Plasticity, capítulo 3. Springer Basic*.
2. Chivardi-Moreno C., *Herrera-Valdez MA*, McKiernan E.C. (2016). Análisis cualitativo de modelos básicos de transmisión infecciosa. *Capítulo 6 del libro Modelización Matemática. Principios y aplicaciones. Textos Científicos, BUAP*, <http://www.fcfm.buap.mx/assets/docs/publicaciones/Modeliza.pdf>

3. Chivardi-Moreno C., *Herrera-Valdez MA*, McKiernan E.C. (2016). Modelos metapoblacionales básicos de transmisión de enfermedades infecciosas. *Capítulo 8 del libro Modelización Matemática. Principios y aplicaciones. Textos Científicos, BUAP*, <http://www.fcfm.buap.mx/assets/docs/publicaciones/Modeliza.pdf>.

Doctoral dissertations

1. Herrera-Valdez MA (2014) Geometry and nonlinear dynamics underlying electrophysiological phenotypes in reduced biophysical models of membrane excitability. *Doctoral dissertation in mathematics, University of Arizona*. Advisor: Joceline Lega.
2. Herrera-Valdez MA (2008) Relationship between nearly coincident spiking and common excitatory synaptic input predicted by a model of spiking motor neurons. *Doctoral dissertation in physiological sciences, University of Arizona*. Advisor: Andrew J. Fuglevand.

Undergraduate thesis

Herrera-Valdez, MA (1997) A rule of thumb not only for gamblers. *Undergraduate thesis for a degree in Actuarial Sciences, U.N.A.M.* Advisor: Luis Alberto Briseño Aguirre. Key words: Probability and stochastic processes, martingales.

Articles under review and published pre-prints

1. Herrera-Valdez MA (2016) A unifying theory to describe transmembrane transport derived from thermodynamic principles. *PeerJ PrePrints* 3:e1613 [doi:dx.doi.org/10.7287/peerj.preprints.1312v6](https://doi.org/10.7287/peerj.preprints.1312v6)

Conference abstracts and published posters (* student, **postdoc).

1. Suárez, P; Herrera-Valdez MA; Bargas, J; Galarraga, E, 2015. Un modelo biofísico de neuronas estriatales de proyección que toma en cuenta la contribución de canales de calcio Cav3. Escuela de Otoño de Biomatemáticas, Jalapa, Veracruz, México.
2. McKiernan EC, Herrera-Valdez MA, Marrone DF, 2015. A biophysical, minimal model to explore age-related changes in ion channel gene expression and excitability in CA1 pyramidal cells. Society for Neurosciences Annual Meeting, Session 628: Learning and Memory: Aging III, [Poster 628.10/AA45](#).
3. Meléndez-Álvarez* JR, McKiernan** EC, and Herrera-Valdez MA, 2012. Temperature dependent transitions in excitability predicted by an electrodiffusion model of membrane potential. *BMC Neuroscience*, 13(Suppl 1):P85. DOI:10.1186/1471-2202-13-S1-P85. OCNS Annual Meeting. Atlanta, 2012.
4. Herrera Valdez MA, 2012. Same ion channel populations and different excitabilities: beyond the conductance-based model. *BMC Neuroscience* 2012, 13(Suppl 1):P120. DOI:10.1186/1471-2202-13-S1-P120. OCNS Annual Meeting. Atlanta, 2012.
5. McKiernan** EC and Herrera Valdez MA, 2012. From spinal cord to hippocampus: links between bifurcation structure, ion channel expression, and firing patterns in a variety of neuron types. *BMC Neuroscience* 2012, 13(Suppl 1):P121. DOI:10.1186/1471-2202-13-S1-P121. OCNS Annual Meeting. Atlanta, 2012.
6. McKiernan** EC and Herrera-Valdez, MA, 2011 Role of the Ca²⁺-activated K⁺ channel slo in shaping locomotor activity (Poster). 20th Annual Puerto Rico Neuroscience Conference. San Juan, Puerto Rico. Dec. 3.
7. Smith* A, Cruz-Aponte* A, McKiernan** EC, Crook S, and Herrera-Valdez MA, 2011. Differential contribution of a-type potassium currents in shaping neuronal responses to synaptic input. *BMC Neuroscience*, 12(Suppl 1):P147. OCNS Annual Meeting. Stockholm, 2011.
8. Herrera-Valdez MA, Smith* A, Cruz-Aponte* M, and McKiernan** EC, 2011. Biophysical modeling of excitability and membrane integration at the single cell and network levels. *BMC Neuroscience*, 12 (Suppl 1):P218. OCNS Annual Meeting. Stockholm, 2011.
9. Cruz-Aponte* M, Smith* A, Herrera-Valdez MA, and McKiernan** EC, 2011. The role of the large-conductance calcium-dependent potassium channel, bk/slowpoke, in shaping motor neuron firing during rhythmic activity. *BMC Neuroscience*, 12(Suppl 1):P217. OCNS Annual Meeting. Stockholm, 2011.

10. Cruz-Aponte* M, **McKiernan EC, Herrera-Valdez MA 2011. On the role of unconfirmed cases and vaccination during an influenza pandemic. 9th Annual More Graduate Education at Mountain States Alliance (MGE@MSA) Student Research Conference at Arizona State University, Tempe, AZ.
11. Strube-Bloss M, Herrera-Valdez MA, Smith BH, 2010. Sensory and learning-induced classification at two stages of processing in the honey bee brain. [Poster 273.1/LL11](#). SFN Meeting, San Diego, Noviembre, 2010.
12. Herrera-Valdez MA, *Berger SD, Duch C, Crook S, 2010. Differential contribution of voltage-dependent potassium currents to neuronal excitability. *BMC Neuroscience* 2010, 11(Suppl 1):P159 doi:10.1186/1471-2202-11-S1-P159. OCNS Annual Meeting. San Antonio, 2011.
13. Herrera-Valdez MA, *Berger SD, Duch, C, and Crook, S (2010). Excitability profiles of *Drosophila* neurons induced by the expression of different potassium channels. OCNS Annual Meeting, San Antonio, Julio, 2010.
14. Cruz-Aponte* M, Herrera-Valdez MA, Castillo-Chávez C, Role of transportation, social distance, and delayed vaccination on the spread of A/H1N1 in Mexico during 2009. MTBI, Tempe, AZ, August 2010 and Infinite Possibilities Conference at UCLA, Los Angeles, CA, Enero 2010.
15. Cruz-Aponte* M, Vega-Guzmán J, Herrera-Valdez MA, Castillo-Chávez, C, The Effect of Cross-Immunity and Control Measures in the Course of an Influenza Pandemic. Eight Annual Student Research Conference of the More Graduate Education at Mountain States Alliance. Arizona State University, Tempe, AZ, Enero 2010.
16. Strube-Bloss M, Herrera-Valdez MA, Smith BH Representation of single odors and their mixture at the input and output stages of the honey bee mushroom body. [Poster 350.2/V27](#). SFN Meeting, Chicago, Octubre, 2009.
17. Satvat E., Herrera-Valdez MA, Gheidi A, Adams AA, Hertel A, Marone DF D1 Receptor activation is not required for place cell-related Arc Expression. [Poster 193.8/EE128](#). SFN Meeting, Chicago, Octubre, 2009.
18. Cruz-Aponte*, M, Vega-Guzmán, J, Herrera-Valdez, MA, Castillo-Chávez, C, The Effects of Cross-immunity and Control Measures in the Course of an Influenza Pandemic. MTBI Final Banquet / Poster Presentations. Arizona State University. Tempe, AZ, August 2009
19. Cruz-Aponte*, M, Vega-Guzmán, J, Barley, K, Morales-Rosado, R, Cherif A, Herrera-Valdez, MA, Castillo-Chávez, C, The Spread of A/H1N1 Varying Treatment, Population Activity, and Transport Between Mexico City and Other Mexican Metropolitan Areas. SIAM Conference in Denver, CO., Junio 2009 and Workshop: Mitigating the Spread of A/H1N1 Flu: Lessons Learned from Past Outbreaks, Arizona State University, Tempe, AZ, Julio 2009.
20. Herrera-Valdez MA, *Berger SD, Duch C, Crook S (2009). Predicting changes in neuronal excitability type in response to genetic manipulations of K⁺-channels. *BMC Neuroscience* 2009, 10(Suppl 1):P301 doi:10.1186/1471-2202-10-S1-P301 OCNS Annual Meeting. Berlin, 2009.
21. Berger* SD, Herrera-Valdez MA, Duch C, Crook S (2009). Passive current transfer in wild type and genetically modified *Drosophila* motoneuron dendrites. *BMC Neuroscience* 2009, 10(Suppl 1):P346 doi:10.1186/1471-2202-10-S1-P346. OCNS Annual Meeting. Berlin, 2009.
22. Herrera-Valdez MA, Fuglevand, AJ (2008). Relationship between nearly coincident spiking and common excitatory synaptic activity in motor neurons. Presented during the Conference on Mechanisms of Plasticity and Disease in Motor Neurons. University of Washington, Seattle, Junio 26-29, 2008. Also poster [75.12/NN1](#) at the Annual Meeting for the SFN, Washington, D.C. Noviembre, 2008.
23. Thome A, Skaggs WE, Herrera-Valdez MA, McNaughton BL, Barnes CA (2007). Effects of performance accuracy on intra-cycle α - and γ -band cross frequency coupling between temporal lobe sites of behaving monkeys. [Poster 744.7/BBB23](#). SFN Meeting, 07-A-34312-SfN.

Reportes técnicos (* indica estudiante asesorado, **postdoc asesorado).

1. Smith A, Herrera-Valdez M, 2009. A minimal biophysical model of phase precession. Mathematical, Theoretical Biology Institute, Arizona State University.
2. Foster A, Hendryx E, Murillo A, Salas M, Morales-Butler E, Suslov S, Herrera-Valdez M, 2010. Extensions of the Cable Equation Incorporating Spatial Dependent Variations in Nerve Cell Diameter. Mathematical, Theoretical Biology Institute, Arizona State University.

Mentoring and advising

Thesis direction. 3 master's and 1 undergraduate student advised.

1. August, 2016-present. Undergraduate thesis director for Alfredo Antonio López, Biology. Proyecto: "Excitabilidad en la regulación de transcripción y variabilidad fenotípica en bacterias".
2. August, 2016-present. Undergraduate thesis director for Donovan Villanueva, en la elaboración de su tesis graduarse de la licenciatura en Ciencias de la Tierra. Proyecto: "Sistemas dinámicos de baja dimensión para modelar el clima"
3. August, 2015-Junio, 2016. Graduate thesis director for Leonardo Remedios Santiago, Maestría en Ciencias Matemáticas, Benemérita Universidad Autónoma de Puebla. Proyecto: "Estudio de bifurcaciones en un proyecto biofísico de excitabilidad celular". Grado obtenido el 20 de Junio del 2016.
4. August, 2014-Marzo, 2016. Undergraduate thesis director for Adrián Tovar López, Lic. en Matemáticas, Universidad Nacional Autónoma de México. Proyecto: "Análisis geométrico y estudio numérico de paso lento por bifurcaciones en el modelaje de la excitabilidad neuronal". Grado obtenido el 7 de Marzo del 2016.
5. August, 2015-Febrero, 2016. Thesis director for Julia Andrea Catalina Falcón Cortés, Maestría en Ciencias Matemáticas, Universidad Nacional Autónoma de México. Proyecto: "Relación entre el fenotipo electrofisiológico y la geometría detrás de la excitabilidad de las células del corazón mamífero". Grado obtenido el 17 de Febrero del 2016.
6. August, 2013-Octubre, 2014. Thesis director for Carlos Chivardi Moreno, Maestría en Economía de la Salud, Instituto Nacional de Salud Pública. Proyecto: "Modelaje de la epidemia de VIH en México tomando en cuenta interacciones entre poblaciones de alto y bajo riesgo". Grado obtenido el 28 de Octubre del 2014.
7. Septiembre, 2009-Diciembre, 2011. Doctoral disertación co-advisor for Maytee Cruz-Aponte (Epidemiología matemática), Graduate Program in Applied Mathematics for the Life and Social Sciences. Arizona State University.

Graduation committees

1. Sinodal de *licenciatura* de Sara Rut Castiblanco Mongui. Grado obtenido en junio de 2016.
2. January 22, 2016. Comité de defensa doctoral de Janet Barroso Flores. Doctorado en Ciencias Biomédicas. Proyecto: "Caracterización de las sinapsis inhibitoras del neoestriado en ratas control y en ratas hemiparkinsonianas".
3. August, 2015 - June, 2016. Revisor de tesinas de 3 estudiantes (Rodrigo Pineda Mondragón, Jesús Antonio Jiménez López, en 2015; Francisco Javier Bautista Zúñiga en 2016) de la maestría en Ciencias Matemáticas.
4. September, 2010 - December, 2011. Miembro de comité de disertación doctoral para 5 estudiantes de posgrado: Grisel Torres (Epidemiología Matemática, ASU), Ricardo Cordero (Ecuaciones diferenciales ordinarias, ASU), Edme Soho (Epidemiología Matemática, ASU), Benjamin Morin (Teoría de redes, ASU), Maytee Cruz-Aponte (Co-asesor, Epidemiología Matemática).
5. January-May, 2012. Asesoré a 21 estudiantes de licenciatura con concentración en matemáticas o en ciencias naturales en proyectos de ciencia teórica en UPRC (scienceandmathgrp.wordpress.com).
6. June-August, 2009 y 2010. Mathematical and Theoretical Biology Institute, ASU. Profesor-mentor de 14 estudiantes (4 de posgrado en 2009, 8 de licenciatura y 2 de posgrado en 2010) en proyectos a nivel licenciatura en ciencia teórica involucrando un alto contenido de matemáticas.

Teaching

Abbreviations: Instituto de Investigaciones Interdisciplinarias (III), University of Puerto Rico in Cayey (UPRC), Dept. Física-Matemática, University of Puerto Rico in Cayey (DMF-UPRC), Arizona State University (ASU), University of Arizona (UA), Facultad de Ciencias (FC), National Autonomous University of Mexico (UNAM).

Courses at UNAM

Recent courses (*Licenciatura, **Posgrado)

1. **Fundamentos matemáticos de fisiología (4.5 horas/semana, 72 horas/semestre, semestre 2016-II, FC-UNAM).
2. *Ecuaciones diferenciales ordinarias I (3 horas/semana, 48 horas/semestre, semestre 2017-II, FC-UNAM).
3. *Seminario de Matemáticas Aplicadas I, fundamentos matemáticos y biofísicos de neurofisiología (5 horas/semana, 80 horas/semestre, semestre 2017-II, FC-UNAM).
4. *Seminario de Análisis Matemático B, espacios de Banach infinito dimensionales (6 horas/semana, 96 horas/semestre, semestre 2017-I, FC-UNAM).
5. *Cálculo Diferencial e Integral I (6 horas/semana, 96 horas/semestre, semestre 2017-I, FC-UNAM).
6. *Cálculo Diferencial e Integral II (6 horas/semana, 96 horas/semestre, semestre 2016-II, FC-UNAM).
7. *Sistemas dinámicos en fisiología (4.5 horas/semana, 72 horas/semestre, semestre 2016-II, FC-UNAM).
8. *Cálculo Vectorial III (6 horas/semana, 96 horas/semestre, semestre 2016-I, FC-UNAM).
9. **Sistemas dinámicos en fisiología (4.5 horas/semana, 72 horas/semestre, semestres 2016-I, 2016-II, FC-UNAM)
10. *Talleres de Biología Sintética (1 hora/semana por taller, 16 semanas, 4 semestres 2015-II, 2016-I, 2016-II, 2017-I, FC-UNAM).
11. *Matemáticas Avanzadas para las Ciencias de la Tierra (6 horas/semana, 96 horas/semestre, semestre 2015-II, FC-UNAM).
12. **Sistemas dinámicos no autónomos (4.5 horas/semana, 72 horas/semestre, 2 semestres (2015-I, FC-UNAM)
13. *Probabilidad II (2 horas/semana, 1 semestre, ayudante, FC-UNAM, 1997)
14. *Topología de dendritas y dendroides (2 horas/semana, 1 semestre, ayudante, FC-UNAM, 1997).

Other courses

1. *Precálculo (2 semestres, DMF-UPRC, 2012)
2. *Cálculo vectorial (1 semestre, DMF-UPRC, 2012).
3. *Geometría universitaria (1 semestre, DMF-UPRC 2011).
4. *Ecuaciones diferenciales ordinarias (1 semestre, DMF-UPRC 2012; 3, UA, 2009)
5. **Seminario de Modelaje matemático para ciencias de la vida y sociales (2 semestres, ASU, 2010).
6. ** Seminario de dinámica evolutiva (1 semestre, ASU, 2011).
7. ** Seminario de ciencia interdisciplinaria (1 semestre, ASU, 2009-2011).
8. *Sistemas adaptables complejos en fisiología (2 semestres, III-UPRC, 2011-2012)
9. *Temas especiales en Matemáticas, Sistemas Dinámicos y Ciencias Cuantitativas (2 semestres, DFM-UPRC, 2012)
10. *Introducción a la biofísica (Física para las biosciencias, 2 semestre, DFM-UPRC, 2012)
11. *Introducción a la ciencia computacional (2 semestres, DFM-UPRC, 2011).
12. *Fisiología de sistemas (2 semestres, UA, 2004-2005).
13. *Estadística (2 semestres, UA, 2000).
14. *Matemáticas discretas (1 semestre, UA, 1999)

15. *Cálculo diferencial e integral (2 semestres, UA 1998-99).
16. *Álgebra (2 semestres, UA, 1997).

Between august of 2011 y dicember of 2012, taught 11 undergraduate courses (3 class hours per week, each). I also developed two interdisciplinary courses, one in dynamical systems for scientific research, the other in quantitative scientific research.

Short courses

1. *(Invitado)* Invited course in dynamical systems in physiology. Universidad Juárez Autónoma de Tabasco. Diciembre 10-14, 2012.
2. *(Invitado)* Series of research lectures in applied mathematics and biophysics at the Mathematical and Theoretical Biology Institute, ASU (2 veranos: 2009 and 2010).
3. *(Taller)* Cryptography session for the workshop on High school mathematics. Department of Mathematics, University of Arizona. Febrero, 2001.

Committees

- Academic Committee for the undergraduate program in applied mathematics at UNAM, Facultad de Ciencias, National Autonomous University of Mexico. March, 2016-present.
- Library representative for the undergraduate program in applied mathematics at UNAM Facultad de Ciencias, National Autonomous University of Mexico. March, 2016-present.
- Undergraduate research coordinator. Mathematics and Physics Department, University of Puerto Rico in Cayey. August, 2011-July, 2012.

Financial support and distinctions

1. **Mexican National System of Researchers**, Level I, CONACyT, México. January, 2015.
2. **Principal Co-investigator**, 2011 Mathematical Field of Dreams Conference (Award #1115165, \$45,000 USD, July 1, 2011 to June, 30, 2012). National Science Foundation, Infrastructure Program, Division of Mathematical Sciences.
3. **Principal Co-investigator**, 2011 Mathematical, Theoretical Biology Institute Summer Course (Award #H98230-11-1-0211, \$389,696 USD, 2 years of funding, June, 2011- December, 2012). National Security Agency.

Scholarships and other support

1. Beca postdoctoral para apoyo y mejoramiento al Posgrado en Matemáticas, UNAM. CONACyT, 2014-2015.
2. Institutional funds, University of Puerto Rico in Cayey (\$15,000 USD, Fall, 2012).
3. Complex Adaptive Systems Initiative (\$90,000 USD, July 2010-June 2011), Arizona State University.
4. Academic Exchange Fellowship (\$7,000 USD, Fall, 1997). Fundación UNAM, 1997.
5. CONACyT graduate scholarship.
6. Outstanding student. Fundación UNAM, 1989-1992, 1994-1995, 1997.

Seminars and conferences imparted

Keynotes

1. Relaciones explícitas entre la estructura de bifurcación y los patrones de expresión de canales en células excitables. XII Encuentro Nacional de Biología Matemática. Centro de Ciencias Matemáticas, Morelia, Universidad Nacional Autónoma de México. October 14, 2016. *EOBM 2016*. *Youtube EOBM 2016*.
2. Modelos biofísicos de excitabilidad celular y geometría detrás de la relación entre expresión genética y la actividad neuronal. Mathematics Summer Course, Instituto de Matemáticas, UNAM-Juriquilla, 2013.
3. Emergence and reactivation of neural traces. All hands meeting at the Temporal Dynamics of Learning Center, University of California in San Diego, January 30, 2011. *Video*.

Other conferences

1. (*Seminar for general public*) Matemáticas en neurofisiología: Un poco de historia y ejemplos de problemas de interés actual. Talk for general public: Hablando de Matemáticas. Instituto de Matemáticas, Universidad Nacional Autónoma de México. September 8, 2016.
2. (*Seminar for general public*) Excitabilidad y estocasticidad en distintos niveles de organización biológica. Coloquio de Orientación Matemática, Facultad de Ciencias, Universidad Nacional Autónoma de México. August 23, 2016.
3. (*Seminar*) Marco Arieli Herrera-Valdez: Excitability and randomness in the dynamics of gene expression. Stochastic and Deterministic Models for Evolutionary Biology, Banff International Research Station, Casa Matemática Oaxaca, August 2, 2016. *Página del taller*. *Video*.
4. (*Seminar*) Sistemas dinámicos, teoría de gráficas y biofísica para estudiar principios generales detrás de la actividad en redes nerviosas. Seminar SUMATE, Facultad de Ciencias, UNAM. April 21, 2016.
5. (*Seminar*) Unificación de modelos de excitabilidad mediante un modelo genérico de transporte transmembranal. Seminar de Biomatemáticas de la Facultad de Ciencias, UNAM. April 28, 2016.
6. (*Invited*) Dilucidando como las interneuronas orquestan el microcircuito estriatal. Taller multidisciplinario - Redes Multidisciplinarias. Cocoyoc, Morelos, October, 2015.
7. (*Invited*) Procesamiento secuencial y formación de representaciones neuronales que ocurren en orden distinto al sugerido por conexiones anatómicas. Seminar Institucional del Instituto de Neurobiología, UNAM. April, 2015.
8. (*Invited*) Procesamiento secuencial y formación de representaciones neuronales que ocurren en orden distinto al sugerido por conexiones anatómicas. Cinvestav. December, 2014.
9. (*Invited*) La variedad en la plasticidad sináptica de corto plazo se explica por el balance entre el llenado y el vaciamiento del pool vesicular: Modelo matemático. Taller multidisciplinario - Redes Multidisciplinarias. October, 2014.
10. (*Invited*) Geometría de excitabilidad en sistemas dinámicos no autónomos para estudiar la diversificación fenotípica en distintos niveles de organización biológica. Instituto de Matemáticas, UNAM, October, 2014.
11. (*Invited*) Geometría de excitabilidad en sistemas dinámicos no autónomos para estudiar la diversificación fenotípica en distintos niveles de organización biológica. Benemérita Universidad Autónoma de Puebla, January, 2014.
12. (*Invited*) Complex geometry underlying the formation of hallucination images. Workshop in Complex Dynamics, Benemerita Universidad Autónoma de Puebla, December, 2013.
13. (*Invited*) Relationship between patterns of ion channel expression and electrophysiological profiles in excitable cells. Seminar de Matemáticas Aplicadas, Instituto de Matemáticas, UNAM. November, 2013.
14. (*Seminar*) Multiple waves of influenza cases caused by asynchronous contributions from multiple locations and human movement. Centro de Investigación Sobre Enfermedades Infecciosas, Instituto Nacional de Salud Pública. October, 2013.

15. *(Invited)* Sobre la combinación de minimalidad, fisicoquímica, y matemáticas para estudiar fisiología. Seminar de Matemáticas Aplicadas. CIMAT, May, 2013.
16. *(Invited)* Estrategias de mitigación basadas en consideraciones sobre transporte, contacto entre individuos, y recursos disponibles para campañas de vacunación. LIM de Evaluación de Programas y Políticas de Salud, Instituto Nacional de Salud Pública. April 2013.
17. *(Invited)* Same cell, different excitability profiles... one dynamical system may not be enough. Cellular and Subcellular Workshop. Mathematical Biosciences Institute, Ohio State University, April, 2013.
18. *(Invited)* Estructura de bifurcación y equivalencia topológica en modelos biofísicos de excitabilidad celular. Instituto de Matemáticas, National Autonomous University of Mexico, Cuernavaca, February, 2013.
19. *(Invited)* Probabilistic approach to study the emergence, reberberance, and spontaneous reactivation of neural traces. Departamento de Ciencias de la Salud, Universidad Autónoma Metropolitana, Lerma, México, January, 2013.
20. *(Invited)* Genetic variation and heterogeneous electrophysiological profiles explained by families of dynamical systems. Max Planck Institute for Chemical Ecology, Jena, Germany, November, 2012.
21. *(Invited)* Beyond the Hodgkin and Huxley model: Combining first principles and dynamical sytonems to explain the relationship between ion channel expression and electrophysiological profiles in neurons. Fourth Meeting Of The BMBF (Bundesministerium für Bildung und Forschung) Neuroscience Groups. University of Bonn, Germany, November, 2012.
22. *(Invited)* Estructura de bifurcación, variación genética, y perfiles electrofisiológicos en neuronas. Instituto de Matemáticas, National Autonomous University of Mexico, Mexico City, November 2012.
23. *(Invited)* Proyectos de multidiciplinarios de investigación en ciencias con un alto contenido en matemáticas. Escuela de verano, Instituto de Matemáticas, UNAM. July 2012, Cuernavaca, México.
24. *(Conference)* Improving the Hodgkin and Huxley model by taking diffusion into account. Seminar Interuniversitario de Investigación en Ciencias Matemáticas. March, 2012, UPR-Mayaguez.
25. *(Conference)* Relating ion channel expression, bifurcation structure, and firing patterns in a biophysical model of a motor neuron. Seminar Interuniversitario de Investigación en Ciencias Matemáticas. March, 2012, UPR-Mayaguez.
26. *(Seminar)* Reactivación conjunta en el cerebro medio y el hipocampo. Seminar de Investigación. Building Research Infrastructure Program, UPRC, January, 2012.
27. *(Seminar)* First principles approach to the study of complex adaptive systems in physiology. BRIC program, Institute for Interdisciplinary Research, University of Puerto Rico in Cayey, October, 2011.
28. *(Seminar)* Undergraduate research opportunities in Neurophysiology and Biophysics: Emergence and reactivation of neural traces. RISE seminar, Department of Biology, University of Puerto Rico in Cayey, October, 2011.
29. *(Invited)* Mechanisms of generation of multiple waves during pandemics. Mathematical epidemiology seminar. Purdue University, March, 2011.
30. *(Invited)* Local approximation and non-topological equivalence between the Hodgkin-Huxley model and electrodiffusion-based model of membrane potential. Biomathematics Seminar, Purdue University, March, 2011.
31. *(Invited)* Data aggregation undelying the multiple surges of infection during the H1N1 pandemic of 2009 in Mexico. Conference on Mathematics in Emerging Infectious Disease Management, Cuernavaca, Morelos, México, January, 2011.
32. *(Talk)* Multiple waves, same pandemic: Influence of transport and social distancing on the dynamics of H1N1. First North-American Meeting for Industrial and Applied Mathematics, Universidad del Mar, Huatulco, México, December, 2010.
33. *(Talk)* *Differential contribution of potassium channels to membrane excitability. SIAM Series on diversity: Neurobiology. July, 2010.

34. *(Talk)* Why are there multiple waves during influenza pandemics? SIAM annual meeting. July, 2010.
35. *(Invited)* The bifurcation structure of biophysical models of membrane potential explains how patterns of gene expression give rise to different excitability profiles in neurons. Oxford University, Medical Research Council, Neuroanatomy and Pharmacology Unit. April, 2010.
36. *(Invited)* Qualitative predictions about the time course of secondary epidemic outbreaks as a function of social distancing, vaccination, and treatment. Continued reports in tripartite meetings between Mexico, Canada, and U.S.A (Tempe, USA, June, 2009, and Vancouver, Canada, September, 2009): Mitigating the spread of AH1N1 influenza. September, 2009.
37. *(Talk)* Effects of vaccination, treatment, and social distancing, on the time course of an A/H1N1 epidemic outbreak. SIAM Annual Meeting, July 2009.
38. *(Talk)* Minimal biophysical models of pacemaking activity in the vertebrate heart. SIAM Annual Meeting, July 2008.
39. *(Invited)* Using nearly coincident spiking to predict common synaptic input to neurons. Computational Physiology seminar, Wilfrid Laurer University, Waterloo, Canada. November, 2008.
40. *(Talk)* Predicting common synaptic input to motor neurons. Biomathematics seminar, Arizona State University. October, 2008.
41. *(Talk)* A low dimensional, biophysical model of cardiac excitability. Biomathematics workshop, SIAM Annual Meeting, July, 2008.
42. *(Talk)* Introduction to the Ventral Tegmental Area. Neural Systems Memory and Aging Colloquium, University of Arizona August, 2007.
43. *(Talk)* Space-dependent responses and synchronization with hippocampal local field potentials are exhibited by spiking activity in neurons of the ventral-tegmental area. Physiological Sciences Seminar, Department of Physiology, University of Arizona August 2005.
44. *(Talk)* Phase-space analysis predicts sexually dimorphic ocular scanning of facial expressions in *Rhesus* monkeys. Physiological Sciences Seminar, Department of Physiology, University of Arizona. August 2004.
45. *(Talk)* Input frequency gates olfactory responses in multiglomerular interneurons of the antennal lobe of *Manduca Sexta*. Physiological Sciences Seminar, Department of Physiology, University of Arizona, August 2003.
46. *(Seminar)* Neural network of the primate primary visual cortex, layer 4C α . Biomathematics seminar, Facultad de Ciencias, UNAM, May, 2002.
47. *(Talk)* Computer reconstructions of dendritic trees based on real morphology. Facultad de Ciencias, UNAM, May, 2002.
48. *(Seminar)* Morphological properties of dendrites: Fractal dimensions. Mathematics Student Colloquium, University of Arizona, March, 2002.d
49. *(Seminar)* Coupling between glomeruli in passive dendritic trees from the antennal lobe of *Manduca Sexta*. Antennal lobe seminar, ARLDN, University of Arizona, May, 2001.
50. *(Seminar)* Models of neural networks of integrate and fire cells. Applied Mathematics Seminar, University of Arizona, October, 2001.
51. *(Seminar)* Dynamical systems and neural systems, introduction to computational neurobiology. Mathematics Student Colloquium, University of Arizona, November, 2001.
52. *(Seminar)* Stochastic modeling of ionic channels. Applied Mathematics Brown Bag Seminar, University of Arizona, 2001.
53. *(Talk)* Financial applications of probability and stochastic processes. Sociedad Matemática Mexicana, Annual Meeting 1997.

Professional organizations

1. Organization for Computational Neurosciences (OCNS, 2009-2012).
2. Biophysical Society (BPS, 2010-2011).
3. Society for Industrial and Applied Mathematics (SIAM, 2008-2011).
4. Society for Neurosciences (SFN, 2008-2010).

Attended courses, workshops, and conferences

1. Topological Data Analysis. CIMAT-UNAM, Diciembre, 2015.
2. The Core Virtues of Teaching Excellence, workshop and on-line course. Dr. Thomas McGovern, Arizona State University. Abril, 2011.
3. NIH Regional Seminar on Program Funding and Grants Administration, multiple seminars and one-on-one meetings with Program Officials. National Institutes of Health. Talking Stick Resort. Scottsdale, Arizona. Abril, 2011.
4. The Ethics of Authorship, ASU professor panel discussion and Q & A session. Arizona State University. Marzo, 2011.
5. Blackwell-Tapia Conference. Mathematical Biosciences Institute, Ohio State University, Noviembre, 2010.
6. SLOAN Foundation Directors Meeting. Tampa, Octubre, 2010.
7. Neuron Course in Parallel Computing, University of Arizona, Tucson, AZ, March, 2010.
8. Conference in Dynamical Systems in Physiology. Mathematics and Bioengineering Departments, Purdue University, Octubre 2008.
9. Short course in Mathematical Physiology. Mathematical Biosciences Institute, Ohio State University, Octubre, 2007.
10. Workshop in Neural Networks. Mathematical Biosciences Institute, Ohio State University, Octubre, 2002.
11. Summer Course of Methods in Computational Neuroscience. Marine Biological Laboratories, Woods Hole, MA, Agosto, 2002.
12. Neuron Simulation Environment Summer Course. San Diego Super Computer Center, Junio, 2001.
13. Reuniones anuales de OCNS, Berlin 2009, San Antonio 2010, Stockholm 2011, Atlanta 2012.
14. Reuniones anuales de SFN, 1998-2000, 2004, 2008, 2010.
15. Reuniones anuales de la Sociedad Matemática Mexicana (SMM) 1995-1998.

Further references: marcoah@ciencias.unam.mx