

Mariana Gómez Schiavon

JUNIOR FACULTY · EVOLUTIONARY SYSTEMS BIOLOGY LAB · LIIGH, UNAM
ADJUNCT INVESTIGATOR · MILLENNIUM INSTITUTE FOR INTEGRATIVE BIOLOGY (CHILE)
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Education

- Ph.D.**, Computational Biology & Bioinformatics
Duke University
- 2016 *Stochastic Dynamics and Epigenetic Regulation of Gene Expression: from Stimulus Response to Evolutionary Adaptation* NC, USA
ADVISOR: Nicolas E. Buchler, PhD
- M.Sc.**, Biomedical Engineering and Physics
Center for Research and Advanced Studies (CINVESTAV), Campus Monterrey
- 2011 *Modeling the regulation of the tryptophanase operon in Escherichia coli* NL, Mexico
ADVISOR: Moisés Santillán, PhD
- 2009 **B.Sc.**, Genome Sciences - National Autonomous University of Mexico (UNAM) Morelos, Mexico

Publications

Nguyen, T. H., Dods, G., **Gómez-Schiavon, M.**, Wu, M., Chen, Z., Kibler, R., Baker, D., El-Samad, H., Ng, A. H. (2021). Competitive displacement of de novo designed heterodimers can reversibly control protein-protein interactions and implement feedback in synthetic circuits. *GEN Biotechnology*. In press.

Gómez-Schiavon, M.*, Dods, G.*, El-Samad, H., & Ng, A. (2020). Multidimensional characterization of parts enhances modeling accuracy in genetic circuits. *ACS Synthetic Biology*, 9(11), 2917–2926. doi:10.1021/acssynbio.0c00288

* Co-first author

Gómez-Schiavon, M.*, & Buchler, N. E. (2019). Epigenetic switching as a strategy for quick adaptation while constraining biochemical noise. *PLoS Computational Biology* 15(10): e1007364. doi:10.1371/journal.pcbi.1007364

* Corresponding author

Chevalier, M.*, **Gómez-Schiavon, M.***, Ng, A., & El-Samad, H. (2019). Design and Analysis of a Proportional-Integral-Derivative Controller with Biological Molecules. *Cell Systems*, 9, 338–353. doi:10.1016/j.cels.2019.08.010

* Co-first author

Ng, A.H., Nguyen, T.H., **Gómez-Schiavon, M.**, Dods, G., Langan, R.A., Boyken, S.E., Samson, J.A., Waldburger, L.M., Dueber, J.E., Baker, D., & El-Samad, H. (2019). Modular and tunable biological feedback control using a de novo protein switch. *Nature*, 572, 265–269.

doi:10.1038/s41586-019-1425-7

Chen, L.-F., Lin, Y.T., Gallegos, D.A., Hazlett, M.F., **Gómez-Schiavon, M.**, Yang, M.G., Kalmeta, B., Zhou, A.S., Holtzman, L., Gersbach, C.A., Grandl, J., Buchler, N.E., & West, A. E. (2019). Enhancer histone acetylation modulates transcriptional bursting dynamics of neuronal activity-inducible genes. *Cell Reports*, 1174–1188. doi:10.1016/j.celrep.2019.01.032

Gómez-Schiavon, M., & El-Samad, H. (2018). Complexity-Aware Simple Modeling. *Current Opinion in Microbiology*, 45, 47–52.

doi:10.1016/j.mib.2018.01.004

Gómez-Schiavon, M., Chen, L.-F., West, A. E., & Buchler, N. E. (2017). BayFish: Bayesian inference of transcription dynamics from population snapshots of single-molecule RNA FISH in single cells. *Genome Biology*, 18:164. doi:10.1186/s13059-017-1297-9

PREPRINTS

Gómez-Schiavon, M.*, El-Samad, H.* (2021). CoRa –A general approach for quantifying biological feedback control. *bioRxiv*.

doi:10.1101/2020.10.09.334078

* Co-corresponding author

Research Experience

Evolutionary Systems Biology Lab · International Laboratory for Human Genome Research (LIIGH) · National Autonomous University of Mexico (UNAM), Campus Juriquilla

Juriquilla, Queretaro, Mexico

PRINCIPAL INVESTIGATOR

2021 - present

RESEARCH TOPIC: Origin and evolution of dynamic properties of gene regulatory circuits

El-Samad Lab, University of California San Francisco (UCSF)

POSTDOCTORAL SCHOLAR

RESEARCH TOPIC: Towards rational design of cellular feedback control

San Francisco, CA, USA

2017 - 2021

Buchler Lab & West Lab, Duke University

RESEARCH FELLOW (GRADUATE STUDENT)

RESEARCH TOPIC: Stochastic dynamics of single-neuron early transcriptional response -A Bayesian approach

Durham, NC, USA

2015-2017

Buchler Lab, Duke University

RESEARCH FELLOW (GRADUATE STUDENT)

RESEARCH TOPIC: Adaptive origin of epigenetic switches in fluctuating environments

Durham, NC, USA

2011-2017

De Luna Lab, LANGEBIO-CINVESTAV

RESEARCH INTERN

RESEARCH TOPIC: Testing longevity in yeast

Irapuato, Gto, Mexico

Spring 2011

Paulsson Lab, Harvard University

RESEARCH INTERN

RESEARCH TOPIC: Exploring the validity of the fluctuation-dissipation theorem in nonlinear stochastic systems

Boston, MA, USA

2010-2011

Santillán Lab, CINVESTAV

RESEARCH FELLOW (MASTERS STUDENT)

RESEARCH TOPIC: Modeling the regulation of the tryptophanase operon in *Escherichia coli*

Monterrey, NL, Mexico

2009-2011

International Genetically Engineered Machine (iGEM) Competition. Team LCG-UNAM-Mexico

RESEARCH FELLOW (UNDERGRAD STUDENT)

RESEARCH TOPIC: Controlling *Escherichia coli* nickel efflux pump

Cuernavaca, Mor, Mexico

2008

Federico Sánchez Lab, IBT-UNAM

RESEARCH FELLOW (UNDERGRAD STUDENT)

RESEARCH TOPIC: Distribution of proline-rich motifs in the genomes of plant and plant-pathogenic organisms

Cuernavaca, Mor, Mexico

2005-2007

Teaching & Mentoring Experience

Molecular Modeling and Simulation (graduate class)

GUEST LECTURER, PONTIFICIA UNIVERSIDAD CATÓLICA DE CHILE

A 90 minutes class about the origin and adaptive advantage of epigenetic switches in fluctuating environments, and a 90 minutes practical class about biochemical noise, and how to model and simulate it.

Virtual

September - November, 2021

Mathematical Modeling of Gene Regulatory Circuits Workshop

INSTRUCTOR, MILLENNIUM INSTITUTE FOR INTEGRATIVE BIOLOGY (iBio), CHILE.

Five sessions of 90 minutes about the basic steps to build a model, the gene circuit motifs and their emergent properties, as well as how to simulate such models deterministic y stochastically.

Virtual

September - October 2021

Biología de Sistemas (doctorate class)

GUEST LECTURER, UNIVERSIDAD MAYOR, CHILE

A 90 minutes class about mathematical modeling of gene regulatory circuits.

Virtual

September 2021

Workshop: How to Model Your Gene Regulatory Circuit

INSTRUCTOR, MILLENNIUM INSTITUTE FOR INTEGRATIVE BIOLOGY (iBio), CHILE.

Weekly meetings with undergraduate and graduate students learning to build and analyze mathematical models of the synthetic gene regulatory circuits they work with.

Virtual

May 2021 - present

Systems Biology (undergraduate course)

LECTURER, INTERNATIONAL LABORATORY FOR HUMAN GENOME RESEARCH (LIIGH), CAMPUS JURIQUILLA, UNAM

Virtual

Fall - 2020

X Summer School of Mathematics of Campus Juriquilla

Class: Mathematical Modeling of Gene Regulatory Circuits

LECTURER, INSTITUTE OF MATHEMATICS, CAMPUS JURIQUILLA, UNAM

Virtual

Summer - 2020

Summer Research Training Program at UCSF

San Francisco, CA, USA

MENTOR, UNIVERSITY OF CALIFORNIA SAN FRANCISCO (UCSF)

Summer - 2019

- Mentee: Matthew Cattle (UCSC)
- Students selected for summer research at UC San Francisco spend up to ten weeks working with UCSF faculty members on research projects. Participants in the program take part in seminars, lectures, and social events, creating a cohesive and supportive community. At the end of the program, students give presentations of their research and get valuable feedback from students, postdocs, and faculty at UCSF.

Modeling Biology, Workshop

Queretaro, Mexico

LECTURER, INTERNATIONAL LABORATORY FOR HUMAN GENOME RESEARCH (LIIGH), UNAM

Spring - 2018

Dynamics in Biology, Mini-term course (high school)

Durham, NC, USA

LECTURER, NORTH CAROLINA SCHOOL OF SCIENCE AND MATHEMATICS (NCSSM)

Spring - 2015

Introduction to Biophysics and Biophysical Chemistry (undergraduate)

Durham, NC, USA

TEACHING ASSISTANT, DEPARTMENT OF PHYSICS & CHEMISTRY, DUKE UNIVERSITY

Spring - 2014

- Professors: Glenn Edwards & David N. Beratan
- Skills taught: regulatory gene circuits, and Gillespie algorithm.

Biophysics in Cell and Developmental Biology (undergraduate)

Durham, NC, USA

TEACHING ASSISTANT, DEPARTMENT OF PHYSICS, DUKE UNIVERSITY

Spring - 2013

- Professor: Nicolas E. Buchler
- Skills taught: critical thinking, research presentation, and grant-writing.

Discrete mathematics course (undergraduate)

Cuernavaca, Morelos, Mexico

TEACHING ASSISTANT, CENTER OF GENOMIC SCIENCES, UNAM

Fall - 2008

- Professor: Margarete Boege von Mentz

Algebra and Trigonometry course (high school)

Cuernavaca, Morelos, Mexico

TEACHING ASSISTANT, ITESM, CAMPUS CUERNAVACA

2003-2004

Mathematical Olympiad training (high school)

Cuernavaca, Morelos, Mexico

TUTOR, MEXICAN MATHEMATICAL OLYMPIAD (OMM)

2004-2008

Mathematics (middle school)

Cuernavaca, Morelos, Mexico

SUBSTITUTE TEACHER, COLEGIO NUEVO CONTINENTE

2003-2004

Oral Presentations

CONFERENCES & SYMPOSIUMS

8th Annual Winter q-bio Meeting

Big Island, HI, USA

SELECTED SPEAKER – CoRA – AN APPROACH FOR QUANTIFYING FEEDBACK CONTROL IN BIOMOLECULAR SYSTEMS

February, 2020

2o Taller Nacional de Biología y Probabilidad, IIMAS, UNAM

Cuernavaca, Mor, Mexico

INVITED SPEAKER – EPIGENETIC SWITCHING AS A STRATEGY FOR QUICK ADAPTATION WHILE ATTENUATING BIOCHEMICAL NOISE

November, 2019

Beyond the Cell Atlas: Theory, Models, and Computation – Chan Zuckerberg Biohub Meeting

Berkeley, CA, USA

SELECTED SPEAKER – QUANTIFYING FEEDBACK CONTROL IN BIOMOLECULAR SYSTEMS

October, 2019

NetSci 2019 – Satellite Symposium “Controlling Complex Networks”

Burlington, VT, USA

INVITED SPEAKER – DESIGN AND ANALYSIS OF A PROPORTIONAL-INTEGRAL-DERIVATIVE CONTROLLER WITH BIOLOGICAL MOLECULES

May, 2019

Horizons in Genomic Sciences 2018, International Colloquium, LIIGH-UNAM

INVITED SPEAKER – QUANTIFYING FEEDBACK CONTROL IN BIOMOLECULAR SYSTEMS

Cancun, QR, Mexico

December, 2018

Horizons in Genomic Sciences 2017, International Colloquium, LIIGH-UNAM

INVITED SPEAKER – TOWARDS RATIONAL DESIGN OF CELLULAR FEEDBACK CONTROL

Cancun, QR, Mexico

September, 2017

LIIGH Inaugural Meeting: International Colloquium on Novel Aspects and Perspectives of Human Genome Research, LIIGH-UNAM

INVITED SPEAKER – EVOLUTIONARY SYSTEMS BIOLOGY

Juriquilla, Qro, Mexico

April, 2015

Winter Q-bio Meeting

SELECTED SPEAKER – EVOLUTIONARY DYNAMICS OF EPIGENETIC SWITCHES IN FLUCTUATING ENVIRONMENTS

Maui, Hawaii, USA

February, 2015

Congreso Conmemorativo del 10o Aniversario de la LCG, CCG-UNAM

INVITED SPEAKER – ORIGEN ADAPTATIVO DE SWITCHES EPIGENÉTICOS EN AMBIENTES FLUCTUANTES

Cuernavaca, Mor, Mexico

January, 2014

Nonlinear Dynamics in Biological Networks, CAMBAM-MBI Summer School, McGill University

SELECTED PARTICIPANT – MODELING TRYPTOPHANASE OPERON REGULATORY CIRCUIT IN *Escherichia coli*

Montreal, QC, Canada

May, 2010

SEMINARS

BioControl Journal Club

CoRA – AN APPROACH FOR QUANTIFYING FEEDBACK CONTROL IN BIOMOLECULAR SYSTEMS

Virtual

October, 2021

Frontiers in Genomics, LCGEJ, LIIGH, UNAM

ORIGIN AND EVOLUTION OF THE DYNAMIC PROPERTIES OF GENE REGULATORY CIRCUITS

Virtual

September, 2021

Evolution Seminar Series. Faculty of Sciences, UNAM.

ORIGEN Y EVOLUCIÓN DE PROPIEDADES DINÁMICAS DE CIRCUITOS DE REGULACIÓN GÉNICA —SWITCHES EPIGENÉTICOS EN AMBIENTES FLUCTUANTES

Virtual

June, 2021

Spring Seminar Series. Advanced Genomics Unit, LANGEBIO-CINVESTAV Irapuato.

ESTRATEGIA PARA CUANTIFICAR EL CONTROL POR RETROALIMENTACIÓN EN SISTEMAS BIOLÓGICOS

Virtual

April, 2021

Reunión iBio 2021. Millennium Institute for Integrative Biology, Chile.

ESTRATEGIA PARA CUANTIFICAR EL CONTROL POR RETROALIMENTACIÓN EN SISTEMAS BIOLÓGICOS

Virtual

March, 2021

Coloquio: Áreas de Investigación de ex-alumnos. CINVESTAV Monterrey.

ESTRATEGIA PARA CUANTIFICAR EL CONTROL POR RETROALIMENTACIÓN EN SISTEMAS BIOLÓGICOS

Virtual

February, 2021

Insights in Signaling Dynamics and Encoding (InSiDE 2020)

CoRA – AN APPROACH FOR QUANTIFYING FEEDBACK CONTROL IN BIOMOLECULAR SYSTEMS

Virtual

September, 2020

UCSF Cell Design Institute Meeting

QUANTIFYING FEEDBACK CONTROL IN BIOMOLECULAR SYSTEMS

San Francisco, CA

November, 2019

Mission Bay Research In Progress Seminar (RIPS), UCSF

QUANTIFYING FEEDBACK CONTROL IN BIOMOLECULAR SYSTEMS

San Francisco, CA

March, 2019

Visiting Professors Program, LIIGH-UNAM

DESIGN AND ANALYSIS OF A PROPORTIONAL-INTEGRAL-DERIVATIVE CONTROLLER WITH BIOLOGICAL MOLECULES

Juriquilla, Qro, Mexico

May, 2018

Developmental Cell and Molecular Biology (DCMB) seminar; Duke University

MAKING SINGLE MOLECULE RNA FISH GREAT AGAIN, OR HOW TO INFER TRANSCRIPTIONAL DYNAMICS FROM LOW THROUGHPUT SNAPSHOTS

Durham, NC, USA

November, 2016

Computational Biology student seminar; Duke University

EVOLUTIONARY DYNAMICS OF EPIGENETIC SWITCHES IN FLUCTUATING ENVIRONMENTS

Durham, NC, USA

March, 2016

Population Biology seminar; Duke University

EVOLUTIONARY EPIGENETICS: SELECTION FOR EPIGENETIC SWITCHES IN FLUCTUATING ENVIRONMENTS

Durham, NC, USA

October, 2014

Posters

8th Annual Winter q-bio Meeting

CoRA – AN APPROACH FOR QUANTIFYING FEEDBACK CONTROL IN BIOMOLECULAR SYSTEMS

Gómez-Schiavon, & El-Samad, Hana

Big Island, HI, USA

February, 2020

qBio 2019 Conference

A SIMPLE AND GENERALIZABLE METRIC FOR QUANTIFYING FEEDBACK CONTROL IN BIOMOLECULAR SYSTEMS

Gómez-Schiavon, & El-Samad, Hana

San Francisco, CA, USA

August, 2019

Duke QBio Symposium, Duke University

BAYESIAN INFERENCE OF TRANSCRIPTION DYNAMICS FROM POPULATION SNAPSHOTS OF SINGLE-MOLECULE RNA FISH IN SINGLE CELLS

Gómez-Schiavon, Mariana, Chen, Liang-Fu, West, Anne E., & Buchler, Nicolas E.

Durham, NC, USA

May, 2017

Populations, Evolution, and Physics; Winter Conference, Aspen Center for Physics

EVOLUTIONARY DYNAMICS OF BISTABLE STOCHASTIC SWITCHES IN FLUCTUATING ENVIRONMENTS

Gómez-Schiavon, Mariana & Buchler, Nicolas E.

Aspen, CO, USA

January, 2016

Biological Control Networks, 12th CRG Symposium, Center for Genomic Regulation

ADAPTIVE ORIGIN OF EPIGENETIC SWITCHES IN FLUCTUATING ENVIRONMENTS

Gómez-Schiavon, Mariana & Buchler, Nicolas E.

Barcelona, Spain

October, 2013

Network Signals & Responses, 8th Annual Duke Systems Biology Symposium, Duke University

ADAPTIVE ORIGIN OF EPIGENETIC SWITCHES IN FLUCTUATING ENVIRONMENTS

Gómez-Schiavon, Mariana & Buchler, Nicolas E.

Durham, NC, USA

October, 2013

Oscillatory Systems in Biology, 7th Annual Duke Systems Biology Symposium, Duke University

In silico EVOLUTION OF GENE CIRCUITS: BISTABILITY AS A STRATEGY TO DEAL WITH FLUCTUATING ENVIRONMENTS

Gómez-Schiavon, Mariana & Buchler, Nicolas E.

Durham, NC, USA

October, 2012

Honors & Awards

Candidato a Investigador Nacional (*Candidate to National Researcher*)

SISTEMA NACIONAL DE INVESTIGADORES (*National Researchers Registry*), CONACYT (MEXICO)

Mexico

2020-2022

AMS-Simons Travel Grant

AMERICAN MATHEMATICAL SOCIETY AND THE SIMONS FOUNDATION

San Francisco, CA, USA

2019-2021

International PhD tuition scholarship CONACYT (MEXICO)	<i>Durham, NC, USA</i> 2015-2016
Special tuition scholarship for academic internship CONACYT (MEXICO)	<i>Boston, MA, USA</i> 2010-2011
Master in Science tuition scholarship CONACYT (MEXICO)	<i>Monterrey, NL, Mexico</i> 2009-2011
Graduated with honors B.S. in Genome Sciences NATIONAL AUTONOMOUS UNIVERSITY OF MEXICO (UNAM)	<i>Cuernavaca, Mor., Mexico</i> 2009
Academic excellence award MINISTRY OF EDUCATION (MEXICO)	<i>Cuernavaca, Mor, Mexico</i> 2009
Bronze medal, team LCG-UNAM-Mexico INTERNATIONAL GENETICALLY ENGINEERED MACHINE (IGEM) COMPETITION	<i>Cambridge, MA, USA</i> 2008
Excellence scholarship for higher education TELMEX FOUNDATION (MEXICO)	<i>Mexico City, Mexico</i> 2005-2011
Research fellowship BIOTECHNOLOGY INSTITUTE, UNAM	<i>Cuernavaca, Mor., Mexico</i> 2005
First place in national phase of the XVIII Mexican Mathematical Olympiad (OMM) SOCIEDAD MATEMÁTICA MEXICANA (SMM)	<i>Edo. Mexico, Mexico</i> 2004

Leadership Experience

Postdoctoral Scholars Association (PSA), University of California San Francisco (UCSF) BOARD MEMBER – COMMUNICATIONS & EVENTS	<i>San Francisco, CA, USA</i> April 2017 - December 2020
Postdoc Union, UAW Local 5810 ELECTIONS COMMITTEE REPRESENTATIVE	<i>San Francisco, CA, USA</i> October 2017 - December 2020
Mathematical Modeling for Biology, Workshop/Postdoc Interest Group (UCSF) ORGANIZER	<i>San Francisco, CA, USA</i> November 2018 - February 2020