

PAUL GERALD LAYAGUE SANCHEZ

Postdoctoral Fellow, Laboratory of Regeneration and Adult Neurogenesis, University of Geneva

Pronouns: he/him/siya

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RESEARCH EXPERIENCE

- 2021 – present **Postdoctoral Fellow, Swiss Government Excellence Scholarship**
Prof. Dr. Brigitte Galliot's Lab, Department of Genetics and Evolution
Laboratory of Regeneration and Adult Neurogenesis
University of Geneva, Geneva, Switzerland
developmental biology, nonlinear dynamics, engineering (microfluidics)
- 2020 – 2021 **Postdoctoral Fellow**
Dr. Alexander Aulehla's Lab, Developmental Biology Unit
European Molecular Biology Laboratory (EMBL), Heidelberg, Germany
developmental biology, nonlinear dynamics, engineering (microfluidics)
- 2019 – 2021 **Oscillations [premiered 23 October 2021]**
with Iván Pérez and Jenny Mahla of the Dance Theatre Heidelberg
nonlinear dynamics (oscillations) in biology and in dance
- 2016 – 2020 **Predoctoral Fellow (PhD Student)**
Dr. Alexander Aulehla's Lab, Developmental Biology Unit
European Molecular Biology Laboratory (EMBL), Heidelberg, Germany
developmental biology, nonlinear dynamics, engineering (microfluidics)
- 2019 **Physical Biology of the Cell Course Student**
Marine Biological Laboratory
Woods Hole, Massachusetts, USA
physical biology, projects with Jonathon Howard and Alvaro Sanchez
- 2018 **Embryology Course Student**
Marine Biological Laboratory
Woods Hole, Massachusetts, USA
developmental biology
- 2015 – 2016 **Research Assistant**
Dr. Chih-Yen King's Lab, Institute of Molecular Biology
Academia Sinica, Taipei, Taiwan
yeast genetics, prion (structural) biology, genomics

2014

Research Intern

Prof. Dr. Michael Boutros's Lab, Signaling and Functional Genomics (B110)
German Cancer Research Center (DKFZ), Heidelberg, Germany
functional genomics, cancer biology

Research Intern

Dr. Chih-Yen King's Lab, Institute of Molecular Biology
Academia Sinica, Taipei, Taiwan
yeast genetics, prion (structural) biology, transcriptomics, proteomics

2010 – 2011

Undergraduate Student Researcher

under the supervision of Dr. Nelson R. Villarante
Department of Physical Sciences and Mathematics (DPSM)
College of Arts and Sciences (CAS)
University of the Philippines Manila, Manila, Philippines
natural products chemistry, rational drug design (computational chemistry)

TEACHING EXPERIENCE

2011 – 2014

Junior Faculty, Lecturer and Instructor (chemistry and biochemistry)

Department of Physical Sciences and Mathematics (DPSM)
College of Arts and Sciences (CAS)
University of the Philippines Manila
Manila, Philippines

AY 2010-2011, Summer

- Chem18.1: Fundamentals of General Chemistry II, Lab (43 students)
- Chem31.1: Elementary Organic Chemistry, Lab (23 students)

AY 2011-2012, First Semester

- Chem18.1: Fundamentals of General Chemistry II, Lab (16 students)

AY 2011-2012, Second Semester

- Chem14.1: Fundamentals of General Chemistry I, Lab (71 students)
- Chem18.1: Fundamentals of General Chemistry II, Lab (10 students)
- Chem31.1: Elementary Organic Chemistry, Lab (24 students)
- Chem40.1: Elementary Biochemistry, Lab (19 students)

AY 2011-2012, Summer

- Chem14: Fundamentals of General Chemistry I, Lecture (34 students)
- Chem18.1: Fundamentals of General Chemistry II, Lab (20 students)
- Chem31.1: Elementary Organic Chemistry, Lab (19 students)

AY 2012-2013, First Semester

- Chem18.1: Fundamentals of General Chemistry II, Lab (41 students)
- Chem31.1: Elementary Organic Chemistry, Lab (22 students)
- Biochem34.1: Chemistry of Biomolecules, Lab (14 students)

AY 2012-2013, Second Semester

- Chem14: Fundamentals of General Chemistry I, Lecture (29 students)
- Chem14.1: Fundamentals of General Chemistry I, Lab (59 students)
- Biochem35.1: Metabolism, Lab (12 students)
- Biochem121.1: Biochemistry of the Gene, Lab (14 students)

AY 2013-2014, Summer

- Chem18.1: Fundamentals of General Chemistry II, Lab (23 students)
- Chem31: Elementary Organic Chemistry, Lecture (29 students)
- Chem31.1: Elementary Organic Chemistry, Lab (18 students)

2007 – 2011

Volunteer Peer Tutor

Learning Resource Center (LRC)
University of the Philippines Manila
Manila, Philippines

EDUCATION

2016 – 2020

PhD/Dr.rer.nat in Developmental Biology and Dynamical Systems Theory

Magna cum laude (dissertation: 1.0, oral defense: 1.0)

European Molecular Biology Laboratory (EMBL)

joint PhD with Ruprecht-Karls-Universität Heidelberg (Heidelberg University)

Thesis: Entrainment of coupled, phase-shifted signaling oscillations in the presomitic mesoderm (Supervisor: Dr. Alexander Aulehla)

doi: 10.11588/heidok.00029209

Thesis defense committee: Prof. Dr. Ulrich Schwarz (Reviewer and Chair), Dr. Justin Crocker (Reviewer), Dr. Lars Hufnagel, Prof. Dr. Nicholas S. Foulkes

2019

Physical Biology of the Cell Course Student

Marine Biological Laboratory
Woods Hole, Massachusetts, USA

2018

Embryology Course Student

Marine Biological Laboratory
Woods Hole, Massachusetts, USA
Testimonial video: <https://youtu.be/zNM6xFfZ2II>

2017

Certificate, Introduction to Dynamical Systems and Chaos

Complexity Explorer, Santa Fe Institute
massive open online course (MOOC) taught by Prof. David Feldman

2016

Predoc course

PhD core course in molecular systems biology
European Molecular Biology Laboratory (EMBL)
Heidelberg, Germany

- 2012 – 2014 **Graduate courses in molecular medicine**
 St. Luke's College of Medicine – William H. Quasha Memorial
 Quezon City, Philippines
- 2006 – 2011 **Bachelor of Science (BSc) in Biochemistry**
Magna cum laude
 University of the Philippines Manila
 Manila, Philippines
 Thesis: Partial characterization of aqueous *Euphorbia hirta* extract (taua taua tea) & docking study of a flavonoid glycoside to Dengue virus serotype 2 NS3-NS2B (Supervisor: Dr. Nelson R. Villarante)

TALKS AND PRESENTATIONS

- 2021 **Sanchez PGL.** “It’s a matter of time: the curious case of the vertebrate segmentation clock – an intro to signaling dynamics in development and disease”, *invited lecture*, Molecular Basis of Human and Plant Diseases course, University of the Philippines Manila, Manila, Philippines
- Sanchez PGL.** “A tail of space and time: on a theory-driven understanding of the vertebrate segmentation clock”, *invited lecture*, Introduction to In-Silico and Meta-Analysis Research: A Webinar for Students and Educators, Institute of Biology, University of the Philippines Diliman, virtual
- Sanchez PGL**, Sonnen K, Tomita T, Mönke G, Merten C & Aulehla A. “Microfluidics-based entrainment of synchronized signaling oscillations in an embryonic tissue”, *oral and poster presentation* (first prize), International Workshop on Mathematical Biology (IWOMB) 2021, virtual
- 2020 **Sanchez PGL.** “Top-down control of embryonic mesoderm segmentation using microfluidics-based entrainment”, *invited talk*, 12th Annual Convention of the Philippine Society for Developmental Biology (PSDB), virtual
- Sanchez PGL**, Sonnen K, Tomita T, Mönke G, Merten C & Aulehla A. “Microfluidics-based entrainment of synchronized signaling oscillations in an embryonic tissue”, *accepted abstract for presentation*, Solvay Workshop on Physics of Living Systems: From Molecules To Cells To Whole Organisms, International Solvay Institutes, Brussels, Belgium [cancelled because of COVID19 pandemic]
- Sanchez PGL**, Sonnen K, Tomita T, Mönke G, Merten C & Aulehla A. “Microfluidics-based entrainment of synchronized signaling oscillations in an embryonic tissue”, *accepted abstract for contributed talk*, 12th European Conference on Mathematical and Theoretical Biology (ECMTB 2020), Ruprech-Karls-Universität Heidelberg, Heidelberg, Germany [cancelled because of COVID19 pandemic]
- Sanchez PGL**, Sonnen K, Tomita T, Mönke G, Merten C & Aulehla A. “Microfluidics-based entrainment enables control of oscillations during patterning in mouse embryos”, *flash talk and poster presentation*, Royal Society Meeting on Interdisciplinary Approaches to Dynamics in Biology, Chicheley Hall, Milton Keynes, UK

- 2019 **Sanchez PGL**, Sonnen K, Tomita T, Mönke G, Merten C & Aulehla A. “Taming waves with pulses: controlling collective dynamics in the presomitic mesoderm using entrainment”, *Developmental Biology Unit seminar*, EMBL, Heidelberg, Germany
- 2019 **Sanchez PGL**, Sonnen K, Mönke G, Merten C & Aulehla A. “Microfluidics-based entrainment of signaling oscillations in mouse somitogenesis”, *poster spotlight (5-min talk + poster presentation)*, qBio 2019 conference, San Francisco State University, San Francisco, California, USA
- Sanchez PGL**, Sonnen K, Mönke G, Merten C & Aulehla A. “Universal entrainment principles enable control of oscillations during patterning in mouse embryos”, *poster presentation* (poster prize), EMBL Lab Day, EMBL, Heidelberg, Germany
- Sanchez PGL**, Mikhaleva S, Ovchinnikova K & Sharan M. “Ally skills hands-on discussion”, *ally skills session (based on materials by Valerie Aurora and Kendra Albert) during the celebration of the International Women’s Day 2019*, EMBL, Heidelberg, Germany
- 2018 **Sanchez PGL**, Sonnen K, Mönke G, Merten C & Aulehla A. “Entrainment of signaling oscillations during segmentation of the presomitic mesoderm”, *Developmental Biology Unit seminar*, EMBL, Heidelberg, Germany
- Sanchez PGL**, Sonnen K, Mönke G, Merten C & Aulehla A. “Microfluidics-based entrainment of signaling oscillations during segmentation of the presomitic mesoderm”, *poster presentation*, CNRS – Jacques Monod Conference on Modeling Cell Fate, Station Biologique de Roscoff, Roscoff, France
- Sanchez PGL**, Sonnen K, Mönke G, Merten C & Aulehla A. “Microfluidics-based entrainment of signaling oscillations in presomitic mesoderm cells”, *poster presentation*, EMBO-EMBL Symposium on Biological Oscillators, EMBL, Heidelberg, Germany
- Sanchez PGL**, Sonnen K, Mönke G, Merten C & Aulehla A. “Investigating signaling oscillations in vertebrate mesoderm segmentation using microfluidics-based entrainment”, *Developmental Biology Unit retreat*, Leistungszentrum Herzogenhorn, Feldberg, Germany
- 2017 **Sanchez PGL**, Sonnen K, Mönke G, Merten C & Aulehla A. “Frequency and phase modulation of oscillatory signaling in mouse PSM cells via microfluidics-based entrainment”, *Developmental Biology Unit seminar*, EMBL, Heidelberg, Germany
- Sanchez PGL**. “Signaling oscillations and spatiotemporal wave patterns in mammalian mesoderm segmentation”, *scientific talk as part of European Learning Laboratory for the Life Sciences (ELLS) Visit to the University of the Philippines Manila as EMBL School Ambassador*, Manila, Philippines
School Ambassador Diary re: the visit: <https://goo.gl/VXKU1P>
- 2017 **Sanchez PGL**, Sonnen K, Mönke G, Merten C & Aulehla A. “Dynamic modulation of oscillatory signaling in the mouse PSM via microfluidics-based entrainment”, *selected talk*, Workshop on Physical Concepts in Stem Cell Biology (StemPhys 2017), Niels Bohr Institute and Danish Stem Cell Center, Tisvildeleje, Denmark

- 2015 **Sanchez PGL**. “Prying into prions: an inquiry into strain variations of protein-only prions – their use, their dominance, and their cellular propagation”, *invited talk*, University of the Philippines Manila, Manila, Philippines
- 2014 **Sanchez PGL**, Leible S, Buljan M, Zhan T & Boutros M. “Development of targeted deep sequencing approach for identification of mutations in cell-free circulating DNA”, *oral presentation*, German Cancer Research Center (DKFZ), Heidelberg, Germany
- Sanchez PGL** & King C-Y. “Functional analysis of SUP35 NM-domain through comprehensive monitoring of gene expression in recombinant *Saccharomyces cerevisiae*”, *poster presentation*, Academia Sinica, Taipei, Taiwan
- 2013 **Sanchez PGL**. “Brain versus movement disorder”, *a lecture series on amyotrophic lateral sclerosis and X-linked dystonia parkinsonism*, St. Luke’s College of Medicine – William H. Quasha Memorial, Quezon City, Philippines
- Sanchez PGL**. “Conflict of Interest and its implications to personal objectivity, scientific integrity, and public trust”, *oral presentation for bioethics course*, St. Luke’s College of Medicine – William H. Quasha Memorial, Quezon City, Philippines

PUBLICATIONS

- 2021 Vogg MC, Ferenc J, Buzgariu WC, Perruchoud C, Papasaikas P, **Sanchez PGL**, Nuninger C, Delucinge-Vivier C, Rampon C, Beccari L, Vriza S, Vincent S, Galliot B, Tsiarris CD. The transcription factor Zic4 acts as a transdifferentiation switch. doi: 10.1101/2021.12.22.473838
- Sanchez PGL**. Entrainment of coupled, phase-shifted signaling oscillations in the presomitic mesoderm. doi: 10.11588/heidok.00029209
- Sanchez PGL**, Mochulska V, Denis CM, Mönke G, Tomita T, Tsuchida-Straeten N, Petersen Y, Sonnen KF, François P, Aulehla A. Arnold tongue entrainment reveals dynamical principles of the embryonic segmentation clock. doi: 10.1101/2021.10.20.465101
- Chang CY, Vila JCC, Bender M, Li R, Mankowski MC, Bassette M, Borden J, Golfier S, **Sanchez PGL**, Waymack R, Zhu X, Diaz-Colunga J, Estrela S, Rebolleda-Gomez M, & Sanchez A. Engineering complex communities by directed evolution. doi: 10.1038/s41559-021-01457-5
- 2020 Chang CY, Vila JCC, Bender M, Li R, Mankowski MC, Bassette M, Borden J, Golfier S, **Sanchez PG**, Waymack R, Zhu X, Diaz-Colunga J, Estrela S, Rebolleda-Gomez M, & Sanchez A. Top-down engineering of complex communities by directed evolution. doi: 10.1101/2020.07.24.214775
- Sanchez PGL** & Vianello S. On the (h)edge: the germline precursors of a basal metazoa are induced at the interface between Hedgehog signalling domains. doi: 10.1242/prelights.16775
- 2019 **Sanchez PGL** & Vianello S. (Transiently) Comfortable in its own “skin”: formation of epithelium-like multicellular structures in a unicellular organism through conserved actomyosin-dependent mechanisms. doi: 10.1242/prelights.9812

- 2019 **Sanchez PGL** & Vianello S. Mind the gap: epiblast geometry at its extraembryonic boundary constrains BMP localization and ensures robust gradient formation. doi: 10.1242/prelights.6820
- 2018 **Sanchez PGL**. On the beauty and wonder of endless forms: a reflection on Embryology Course 2018. published online on *the Node* – community site run by *Development* (2018). <http://thenode.biologists.com/on-the-beauty-and-wonder-of-endless-forms/education/>
- 2016 **Sanchez PGL**. InGenuity: NextGen's vision for an urban planet: How can scientists in your field help society prepare for an increasingly urbanized world? doi: 10.1126/science.aag1520 at <http://science.sciencemag.org/content/suppl/2016/05/18/352.6288.886.DC1>
- 2013 **Sanchez PGL**. NextGenVOICES: What one change would most improve work-life balance for scientists? doi: 10.1126/science.342.6154.36 at <http://scim.ag/NextGen8Results>

HONORS, AWARDS, AND FELLOWSHIPS

- 2021 – present **Postdoctoral fellowship, Swiss Government Excellence Scholarship**
Swiss Federal Commission for Scholarships for Foreign Students (Swiss FCS)
- 2011 – present **License as chemist**
Board of Chemistry, Professional Regulation Commission, Philippines
- 2020 – 2021 **Postdoctoral fellowship, EMBL Bridging Postdoctoral Fellow**
linked to ERC-funded project CollectiveDynamics: collective signaling oscillations in embryonic patterning – revealing underlying principles
- 2020 **Magna cum laude (dissertation: 1.0, oral defense: 1.0)**
PhD/Dr.rer.nat in Developmental Biology and Dynamical Systems Theory
joint PhD between the European Molecular Biology Laboratory (EMBL) and Ruprecht-Karls-Universität Heidelberg (Heidelberg University)
- 2016 – 2020 **Predoctoral fellowship, EMBL International PhD Programme**
linked to ERC-funded project Oscillations: oscillatory signaling dynamics – a quantitative approach to reveal their origin and function in development
- 2019 **Scholarship award to attend the PhysBio of the Cell Course in Woods Hole**
Arthur Klorfein Scholarship and Fellowship Fund
- 2018 **Scholarship awards to attend the Embryology Course in Woods Hole**
a. Burroughs Wellcome Fund – Embryology Course
b. The Company of Biologists Ltd Scholarship – Embryology
c. Helmsley Charitable Trust – Embryology
d. Horace W. Stunkard Scholarship Fund
- 2017 **Workshop/conference fellowship**
Workshop on Physical Concepts in Stem Cell Biology (StemPhys 2017) Niels Bohr Institute and Danish Stem Cell Center, Tisvildeleje, Denmark

- 2016 **British Council Ambassador, IELTS Prize**
British Council in the Philippines
- 2014 **International Research Fellowship (for research internship)**
Helmholtz International Graduate School for Cancer Research (HIGS)
German Cancer Research Center (DKFZ), Germany
- International Research Fellowship (for research internship)**
Taiwan International Graduate Program (TIGP), Academia Sinica, Taiwan
- 2013 **Finalist, Local Biocamp, Novartis Philippines**
- 2011 **Plaque of Recognition for Filipino Chemists**
The Amando Clemente Memorial Foundation, Inc.
linked to ranking first in the 2011 nationwide licensure examinations for chemists in the Philippines
- 1st Place, Philippine Chemistry Licensure Examinations**
Board of Chemistry, Professional Regulation Commission, Philippines
- Magna cum laude***
Bachelor of Science (BSc) in Biochemistry
University of the Philippines Manila

SERVICE, VOLUNTEERING, AND OUTREACH

- 2021 **Oscillations [premiered 23 October 2021]**
with Iván Pérez and Jenny Mahla of the Dance Theatre Heidelberg
a trans-disciplinary collaboration (2019-2021) comparing and contrasting oscillations in embryonic development and in dance
introductory video: <https://fb.watch/6c542xzCkx/>
- Contributor, Promotional Vid for the Swiss Gov't Excellence Scholarships**
with the Embassy of Switzerland in the Philippines
<https://fb.watch/adccA70lme/>
- Judge, Best Undergraduate Thesis in Biology**
Department of Biology, University of the Philippines Manila
- 2021 – present **Member**
Philippine Association of Marine Science (PAMS)
- 2020 – present **Member**
Philippine Society for Developmental Biology (PSDB)
- 2019 – present **Signatory**
San Francisco Declaration on Research Assessment (DORA)
<https://sfdora.org/read/>

- 2019 – 2021 **preLighter, Contributor**
with Stefano Vianello
preLights: preprint highlights, selected by the biological community
The Company of Biologists
- 2019 **Volunteer/Instructor, EMBL Summer School for Undergraduates**
with the EMBL International PhD Programme Graduate Office
summer program targeting advanced undergraduate students in chemistry, physics, engineering, mathematics and computer sciences
- 2019 **Organizer, LGBT+ STEM Day at EMBL**
EMBL Equality and Diversity Committee and EMBL Staff Association
international day of LGBTQ++ in science, technology, engineering, & math
- 2019 **Organizer, Bake Sale for International Day Against Homophobia, Transphobia, and Biphobia (IDAHOTB)**
EMBL Equality and Diversity Committee and EMBL Staff Association
fundraising event for KOSI.MA, a sexually-transmitted infections-related support and testing center in Mannheim, Germany
- 2019 **Facilitator, Ally Skills Hands-On Discussion**
with the Equality and Diversity Committee & Staff Association
European Molecular Biology Laboratory (EMBL)
ally skills session during the International Women's Day 2019
- 2018 - 2019 **LGBTQ++ Community Representative**
Equality and Diversity Committee
European Molecular Biology Laboratory (EMBL)
- 2018 **Graduate Student Committee, EMBL Benefit Gala**
with the EMBL International PhD Programme Graduate Office and EMBL Office of Resource Development
fundraising event for The EMBL Summer School for Undergraduates
- 2018 **Organizer, LGBT+ STEM Day at EMBL**
EMBL Equality and Diversity Committee and EMBL Staff Association
international day of LGBTQ++ in science, technology, engineering, & math
- 2017 **Organizer, Inaugural Rainbow Beer Session**
EMBL Equality and Diversity Committee and EMBL Staff Association
inaugural get-together of LGBTQ++ at EMBL, their friends, and their allies
- 2017 **Organizer, 19th EMBL PhD Symposium**
Bridging the Gaps: Interdisciplinary Approaches in Life Sciences
Heidelberg, Germany

- 2017 **Coordinator, Basic Teaching Module of EMBL Predoc Course 2017**
EMBL International PhD Programme (EIPP)
coordinated and organized the first teaching module of predoc course – PhD core course in molecular systems biology
- 2013 – 2015 **RITM-AIDS Research Group (ARG)-trained Educator and Counselor**
LoveYourself, Inc. with the Research Institute for Tropical Medicine (RITM)
actively advocated for HIV awareness, education, screening, and counseling, especially for at-risk populations in the Philippines
- 2010 **Medico-Legal Trainee**
Forensic Service, National Bureau of Investigation (NBI), Philippines
- 2009 – 2010 **Vice President for Internal Affairs**
University of the Philippines Biochemistry Society
University of the Philippines Manila