

# PAUL GERALD LAYAGUE SANCHEZ

Postdoctoral Fellow, European Molecular Biology Laboratory (EMBL)

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## RESEARCH EXPERIENCE

- 2020 – present      **Postdoctoral Fellow**  
Dr. Alexander Aulehla's Lab, Developmental Biology Unit  
European Molecular Biology Laboratory (EMBL), Heidelberg, Germany  
*developmental biology, nonlinear dynamics, engineering (microfluidics)*
- 2019 – present      **ongoing collaboration, Oscillations**  
with Iván Pérez and Jenny Mahla of the Dance Theatre Heidelberg  
planned to premiere in November 2020, postponed because of pandemic  
*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*
- 2014      **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

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 Ruprech-Karls-Universität Heidelberg (Heidelberg University)  
Thesis: Entrainment of coupled, phase-shifted signaling oscillations in the  
presomitic mesoderm (Supervisor: Dr. Alexander Aulehla)  
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**, 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*, International Workshop on Mathematical Biology (IWOMB) 2021, virtual
- 2020    **Sanchez PGL**. "Top-down control of embryonic mesoderm segmentation using microfluidics-based entrainment", *invited talk*, 12<sup>th</sup> 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*, 12<sup>th</sup> 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

**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
- 2013 **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 **Sanchez PGL**. Entrainment of coupled, phase-shifted signaling oscillations in the presomitic mesoderm. doi: 10.11588/heidok.00029209
- 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
- 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

- 2020 – present      **Postdoctoral fellowship, EMBL Bridging Postdoctoral Fellow**  
*linked to ERC-funded project CollectiveDynamics: collective signaling oscillations in embryonic patterning – revealing underlying principles*
- 2011 – present      **License as chemist**  
Board of Chemistry, Professional Regulation Commission, Philippines
- 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*

2011                      **1<sup>st</sup> 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 – present            **Member**  
Philippine Association of Marine Science (PAMS)

2020 – present            **Member**  
Philippine Society for Developmental Biology (PSDB)

2019 – present            **preLighter, Contributor**  
with Stefano Vianello  
preLights: preprint highlights, selected by the biological community  
The Company of Biologists

**ongoing collaboration, Oscillations**

with Iván Pérez and Jenny Mahla of the Dance Theatre Heidelberg  
*a trans-disciplinary collaboration comparing and contrasting oscillations in embryonic development and in dance*

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*

**Organizer, LGBT+ STEM Day at EMBL**  
EMBL Equality and Diversity Committee and EMBL Staff Association  
*international day of LGBTQ++ in science, technology, engineering, & math*

**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*

**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*
- 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, 19<sup>th</sup> EMBL PhD Symposium**  
Bridging the Gaps: Interdisciplinary Approaches in Life Sciences  
Heidelberg, Germany
- 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