桑保羅 PAUL GERALD LAYAGUE SANCHEZ, Dr. rer. nat.

Postdoctoral Fellow, Laboratory of Aquatic Zoology
Yilan Marine Research Station, Institute of Cellular and Organismic Biology, Academia Sinica
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RESEARCH EXPERIENCE

2022 – present
Postdoctoral Fellow
Prof. Kinya Ota's Lab, Yilan Marine Research Station
Laboratory of Aquatic Zoology
Institute of Cellular and Organismic Biology, Academia Sinica, Taiwan
developmental biology, *evolutionary biology, aquatic zoology*

2021 – 2022
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
documentary movie: https://youtu.be/rT5I-itcA9I

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

2023 **Sanchez PGL.** "Yolk dynamics in goldfish: *independent irritability* of goldfish eggs and embryos", *presentation in the internal meeting of the EcoEvoDevo focus group*, Academia Sinica, Taipei, Taiwan

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]

2020 **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), Ruprecht-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

2017 **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

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

2024 Miyazawa H, Rada J, **Sanchez PGL**, Esposito E, Bunina D, Girardot C, Zaugg J, Aulehla A. Glycolysis-Wnt signaling axis tunes developmental timing of embryo segmentation.
doi: 10.1101/2024.01.22.576629

2023 **Sanchez PGL**, Wang CY, Li IJ, Ota KG. On the *independent irritability* of goldfish eggs and embryos – a living communication on the rhythmic yolk contractions in goldfish.
doi: 10.1101/2023.11.02.564871
corresponding author

2022 Vogg MC, Ferenc J, Buzgariu WC, Perruchoud C, **Sanchez PGL**, Beccari L, Nuninger C, Le Cras Y, Delucinge-Vivier C, Papasaikas P, Vincent S, Galliot B, Tsiairis CD. The transcription factor Zic4 promotes tentacle formation and prevents epithelial transdifferentiation in *Hydra*.
doi: 10.1126/sciadv.abo0694

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: 10.7554/eLife.79575

2021 Vogg MC, Ferenc J, Buzgariu WC, Perruchoud C, Papasaikas P, **Sanchez PGL**, Nuninger C, Delucinge-Vivier C, Rampon C, Beccari L, Vriz S, Vincent S, Galliot B, Tsiairis 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

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/

HONORS, AWARDS, AND FELLOWSHIPS

2023 – present **Postdoctoral fellowship, Academia Sinica Postdoc Fellowship Program**
Academia Sinica, Taiwan

2011 – present **License as chemist**
Board of Chemistry, Professional Regulation Commission, Philippines

2021 – 2022 **Postdoctoral fellowship, Swiss Government Excellence Scholarship**
Swiss Federal Commission for Scholarships for Foreign Students
Swiss FCS

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 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

2024 – present **Member**
Philippine Society for Mathematical Biology (PSMB)

2023 – present **Thesis Adviser, Undergraduate Thesis in Biochemistry**
adviser of Crisandro Allen Lazo, co-supervised with Dr. Junie B. Billones
Department of Physical Sciences and Mathematics
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/

2023 – 2024 **Board Member**
Philippine Society for Developmental Biology (PSDB)

2023 **Organizer, 15th Annual Convention of the PSDB**
Philippine Society for Developmental Biology (PSDB)

Organizer, MARVELous Goldfish - FINtastic Forms
exhibit of the Laboratory of Aquatic Zoology for the 2023 Open House
Academia Sinica, Taipei, Taiwan

Organizer, 2023 PSDB Masterclass
Philippine Society for Developmental Biology (PSDB)
masterclass (lecture and hands-on workshop) on plant and animal developmental biology (and pedagogy) for educators

Organizer, 2023 PSDB Webinar Series
Philippine Society for Developmental Biology (PSDB)
webinar series on plant and animal developmental biology

2022 **Organizer, Skeletal Staining Exhibit**
exhibit of the Laboratory of Aquatic Zoology for the 2022 Open House
Academia Sinica, Taipei, Taiwan

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/
documentary movie: https://youtu.be/rT5I-itcA9I

2021 **Contributor, Promo Video for the Swiss Gov't Excellence Scholarships**
with the Embassy of Switzerland in the Philippines
https://fb.watch/adccA70Ime/

Judge, Best Undergraduate Thesis in Biology
Department of Biology, University of the Philippines Manila

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

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, 19th 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