

Irwin I. Puc, PhD

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Summary

Dr. Puc holds a PhD in Medical Sciences and a Master's degree in Microbiology and Immunology from National Cheng Kung University, Taiwan. His expertise has been shaped through both his PhD and postdoctoral training, spanning viral pathogenesis, host-virus interactions, immunology, chronic inflammation, immuno-oncology, unconventional T cell biology, nanoparticle-based drug delivery systems, organ-on-a-chip platforms and translational biomedical engineering. His education and training have given him hands-on experience and conceptual skills in academic teaching and student mentoring, at a university graduate level. He possesses a solid understanding of Bench-to-Bedside Clinical and Translational Research practices, with the ability to design, execute, and communicate research projects independently or collaboratively, with collaborators from both academic and non-academic sectors. As a motivated and passionate researcher, his long-term goal is to advance translational medicine by integrating immunology, bioengineering, and emerging biomedical technologies to better understand disease mechanisms and develop next-generation therapeutic strategies for cancer, inflammatory disorders, and regenerative medicine.

Core competencies

Research Interest: T Cell Immunology, Immuno-oncology, Metabolic Disease, Single-Cell and Spatial Transcriptomics, Immunotherapy, Biomarkers, Cold Atmospheric Plasma, Organ-on-a-Chip, Nanomedicine and Nanoparticle-Based Drug Delivery
Personal qualities: Team Player, Communication, Critical Thinker, Problem Solving, Multitasking, Time Efficient, Adaptability
Language: English (native), Spanish (native), Mandarin Chinese (professional working proficiency)
Coding: R, Model Evaluation: ROC analysis, Tree-based models (Decision Trees, Random Forests), FlowCore, Seurat Packages, HTML, CSS
Experimental techniques/assays: Mass-Cytometry (CyTOF), Flow Cytometry, Tetramer/Antibody Conjugation, Confocal Microscopy, Proteomics, scRNA-seq, RNA Interference, Laboratory techniques (Cell Culture, Handling/processing Human Clinical Samples, ELISA, CO-IP, RT-PCR, Western blot), Mouse/Rat Handling, Molecular Cloning, High-dimensional Data Analysis and Visualization.

Professional Experience

Postdoctoral Fellow

National Taiwan University, Department of Biomechanics Engineering,

Taipei, Taiwan

Conducting interdisciplinary research in translational bioengineering, focusing on nanoparticle-based drug delivery, cold atmospheric plasma-mediated immunomodulation, and microfluidic organ-on-a-chip platforms; advised by Prof. Yung-Te Hou.

Jan 2026 - Present

- Investigate the therapeutic potential of decellularized liver extracellular matrix (dECM)-based nanomedicine as a targeted drug delivery platform for liver regeneration and hepatocellular carcinoma treatment.
- Optimizing nanoparticle-based drug delivery systems utilizing liver-derived biomaterials to enhance therapeutic efficacy, biocompatibility, enhanced cellular uptake and tissue-specific targeting.
- Investigating cold atmospheric plasma (CAP) as an immunomodulatory strategy for remodeling the tumor microenvironment and enhancing anti-tumor immune responses.
- Engineering microfluidic organ-on-a-chip platforms that mimic human liver physiology for preclinical drug screening and disease modeling.
- Evaluating drug efficacy, drug-induced liver injury (DILI), and immune-related adverse events (irAEs) using physiologically relevant organ-on-a-chip platforms to improve translational drug development.

Postdoctoral Fellow

Academia Sinica, Institute of Biomedical Science

Taipei, Taiwan

Trained in high-dimensional tissue-specific immune profiling and rare antigen-specific T cell analysis; advised by Asst. Professor Cheng Yang

Jul 2023 - Jul 2025

- Investigated the roles of conventional and unconventional T cells in the chronic HBV infection, HBV-associated liver disease and liver cancer.
- Investigated CD1d-restricted iNKT and MR1-restricted MAIT cells across human tissues using tetramer staining and mass cytometry, to assess their functional states and immunological roles.
- Developed lipid-loaded tetramers and Endo-tetramers to study rare CD1a/b/c-restricted iNKT cells and assess their functional states and immunological roles in psoriasis, polycythemia vera, and liver cancer.
- Investigated the role and phenotypic profiles of myeloid cells in patients with chronic rhinitis, with an emphasis on distinguishing type 2 versus non-type 2 inflammation and understanding how immune responses to environmental allergens drive airway inflammation.
- Established and optimized comprehensive antibody panel tailored for high-dimensional analysis using the CyTOF system, facilitating the precise quantification and characterization of immune cell populations and their phenotypic markers.
- Generated preliminary data for grant applications, contributing to the development of research proposals for the securing of funding for ongoing projects and fostering collaborative research opportunities.
- Implemented and optimized new experimental protocols for laboratory use, enhancing the efficiency and reproducibility of immunological assays and data collection.

Researcher & Laboratory Assistant

National Cheng Kung University, Institute of Basic Medical Sciences

Tainan, Taiwan

Trained in viral immunology, stem cell dynamics in dengue, predictive modeling, and biomarker discovery in dengue pathogenesis; advised by Prof. Oscar Guey-Chuen Perng†.

Jan 2019 - Jun 2023

- Investigated cytokine signatures in dengue patients across different disease severities and used predictive modeling to identify severity biomarkers.

- Investigated dengue virus entry receptors in hematopoietic stem and progenitor cell populations using proteomics, binding assays and receptor-blocking experiments.
- Investigated the mobilization, functional capacity, and latent viral potential of hematopoietic stem and progenitor cells in dengue patients and in vertical transmission during pregnancy.
- Implemented new experiment protocols for lab use.
- Designed and prepared new experiment for preliminary data for grant applications.
- Maintained laboratory equipment and reagent inventory, ensuring that all supplies were available and in good working order.

Researcher Assistant

University of Belize, Micro-propagation Research Laboratory
Supervised by Prof. Stephen Williams

Belmopan, Belize
Aug 2013 - Aug 2015

- Perform laboratory experiments.
- Execute new protocols for more efficient propagation.
- Maintained laboratory equipment and reagent inventory, ensuring that all supplies were available and in good working order.
- Maintained database of: expenses, materials and study data.
- Trained and supervised new laboratory members, providing guidance on experimental techniques and safety protocols.

Techning Experience

Guest Lecturer

National Taiwan University

Teaching opportunity provided by Prof. Yung-Te Hou to gain hands-on experience in academic teaching under his mentorship.

1. Biology for Engineers (Course No. BME1110)
Undergraduate Program, Semester 2
 - Chapter 17: The Immune Response

Taipei, Taiwan
Spring Semester 2026

Teaching Practicum / Guest Lecturer

National Cheng Kung University

Teaching opportunity provided by Prof. Oscar Guey-Chuen Perng to gain hands-on experience in academic teaching under his mentorship.

1. Introduction to Translational Medicine (Course No. S452300)
Graduate Program, Semester 2
 - Module 2: Introduction to Translational Medicine
 - Module 4: Conflict of Interest
 - Module 15: Clinical Operation through Data Visualization
 - Module 16: Ethics of Human Research

Tainan, Taiwan
Fall Semester 2020

2. Research Integrity (Course No. S452500)
Graduate Program, Semester 1
 - Module 3: Data Management and Sharing.

Tainan, Taiwan
Spring Semester 2021

Education

Ph.D in Basic Medical Sciences

National Cheng Kung University

Thesis title: Longitudinal analysis of cytokine and hematopoietic stem cells mobilization profiling in subsequent dengue infection.

Advisor: Prof. Oscar Guey-Chuen Perng[†] & Co-Advisor Prof. Shaw-Jenq Tsai

Tainan, Taiwan
Jan 2019 - Jun 2023

M.Sc in Microbiology and Immunology

National Cheng Kung University

Thesis title: Skin stem cells are highly permissive to dengue virus infection.

Advisor: Prof. Oscar Guey-Chuen Perng[†]

Tainan, Taiwan
Aug 2016 - Jan 2019

B.S in Biology

University of Belize

Thesis title: Effects of four different capping systems in the micropropagation of sugarcane (*Saccharum officinarum*) Variety B79-474.

Advisor: Dr. Dion Daniels

Belmopan, Belize
Jan 2011 - Jun 2015

A.S in Computer Science

University of Belize

Belmopan, Belize
Jan 2011 - Jun 2013

Publications

1. Vats, Amrita; Ho, Tzu-Chuan; **Puc, Irwin**; Chang, Chiung-Hsin; Perng, Guey Chuen; Chen, Po-Lin. 2023. *The CD133 and CD34 cell types in human umbilical cord blood have the capacity to produce infectious dengue virus particles*. Scientific Reports. DOI:10.1038/s41598-023-37707-8
2. **Puc, Irwin**; Ho, Tzu-Chuan; Chien, Yu-Wen; Tan, Sia-Seng; Fong, Yu-Cin; Yen, Ko-Lun; Chen, Yi-Ju; Wang, Sheng-Hsuan; Li, Yun-Hsuan; Chen, Po-Lin; Perng, Guey Chuen; Tsai, Jih-Jin. 2022. *Mobilizing capacity of hematopoietic stem and progenitor cells during dengue virus infection*. International Journal of Molecular Sciences. DOI:10.3390/ijms232214330
3. Chen, Yi-Ju; Ho, Tsao - Yu-Cian; Ho, Tzu-Chuan, **Puc, Irwin**; Chen, Chia-Chang; Perng, Guey Chuen. 2022. *Antrrodia cinnamomea Suppress Dengue Virus Infection through Enhancing the Secretion of Interferon-Alpha*. Plants. DOI:10.3390/plants11192631
4. Vats, Amrita; Ho, Tzu-Chuan; **Puc, Irwin**; Chen, Yi-Ju; Chang, Chiung-Hsin; Chien, Yu-Wen; Yen, Ko-Lun; Perng, Guey Chuen. 2021. *Evidence that hematopoietic stem cells in human umbilical cord blood is infectable by dengue virus: proposing a vertical transmission candidate*. Heliyon. DOI:10.1016/j.heliyon.2021.e06785
5. **Puc, Irwin**; Ho, Tzu-Chuan; Yen, Ko-Lun; Vats, Amrita; Tsai, Jih-Jin; Chen, Po-Lin; Chen, Yu-Wen; Lo, Yu-Chih; Perng, Guey Chuen. 2021. *Cytokine Signature of Dengue Patients at Different Severity of the Disease*. International Journal of Molecular Sciences. DOI:10.3390/ijms22062879
6. **Puc, Irwin**; Alegria, Javier; Dion, Daniels; Guerra, Daniels; Williams, Stephan. 2017. *Effects of Four Different Capping Systems in the Micropropagation of Sugarcane (Saccharum officinarum) Variety B79-474*. International Journal of Scientific Engineering and Research. DOI:10.13140/RG.2.2.10699.49440

Patents

- 1. Use of dengue virus for preparing anti-hepatoma drug. Taiwan Patent No.: **TWI873401B**. Date Issued: February 21, 2025.
 - Description: A method for treating hepatoma using dengue viruses that selectively infect and eliminate liver tumor stem cells

Peer Review Activities

- Reviewer, Scientific Reports (**Nature Portfolio**)
- Reviewer, BMC Infectious Diseases (**Springer Nature**)
- Reviewer, Discover Viruses (**Springer Nature**)

Honors and Awards

- The Chung Hwa Rotary Educational Foundation Taiwan Rotary Academic Scholarship (**2022-2023**)
 - Awarded for academic excellence and commitment to leadership and community service, supporting outstanding international graduate students in Taiwan.
- The Chung Hwa Rotary Educational Foundation Taiwan Rotary Academic Scholarship (**2020-2021**)
 - Awarded for academic excellence and commitment to leadership and community service, supporting outstanding international graduate students in Taiwan.
- NCKU Distinguished Scholarship (**2019-2023**)
 - Competitive merit-based scholarship granted annually to top-performing graduate students for sustained academic achievement and research excellence.
- MOFA Taiwan Scholarship (**2015-2018**)
 - Prestigious, fully funded government scholarship awarded to only five top Belizean students per year based on academic excellence and leadership potential, supporting graduate study in Taiwan.

Certificates and Training

Standard BioTools™ - CyTOF XT Core Operator Training

- XT101 and 201 Training Course (**2023**)
 - Gained hands-on experience in mass cytometry operation, quality control and instrument maintenance, with advanced training in troubleshooting, optimization, data cleanup and batch effect management.

National Cheng Kung University IRB Training Programme

- Preparation for Investigator-Initiated Trials (**2019**)
 - Gained practical understanding of designing, submitting, and managing investigator-led clinical research while ensuring ethical compliance and regulatory standards.
- The Design, Operation, and Risk Management of Clinical Trials (**2019**)
 - Trained in planning, executing, and monitoring clinical trials with an emphasis on identifying and mitigating operational and ethical risks.
- Early Phase Clinical Trial Design (**2017**)
 - Focused on the principles and challenges of designing first-in-human and dose-escalation studies in early-stage clinical research.
- Investigational Product Development and the FDA (**2017**)
 - Acquired foundational knowledge in investigational new drug (IND) application processes, FDA regulations, and product development pathways from lab to clinic.

Personal Data

- Full Name: Irwin Ivandi Puc
- Nationality: Belizean
- Gender: Male
- Marital Status: Married
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- Work Email: irwinpuc@ntu.edu.tw