BIOGRAPHICAL SKETCH

Provide the following information for the Senior/key personnel and other significant contributors.
Follow this format for each person. **DO NOT EXCEED FIVE PAGES.**

NAME: Chung, Philip

eRA COMMONS USER NAME (credential, e.g., agency login): philipchung

POSITION TITLE: Postdoctoral Fellow & Clinical Scholar, Stanford University

EDUCATION/TRAINING *(Begin with baccalaureate or other initial professional education, such as nursing, include postdoctoral training and residency training if applicable. Add/delete rows as necessary.)*

INSTITUTION AND LOCATION	DEGREE *(if applicable)*	Start Date MM/YYYY	Completion Date MM/YYYY	FIELD OF STUDY
University of California, Berkeley	BS	08/2006	05/2010	Bioengineering
University of California, Berkeley & San Francisco *(joint program)*	MS	07/2010	07/2011	Bioengineering *(emphasis in Translational Medicine)*
University of California, San Francisco	MD	09/2014	05/2019	Medicine
University of Washington	Residency	06/2019	06/2023	Anesthesiology
Stanford University	Postdoctoral Fellow	08/2023	present	Anesthesiology

A. Personal Statement

I am a physician-scientist specializing in anesthesia clinical informatics, natural language processing, machine learning, and artificial intelligence. During medical school, I became interested in approaches to leverage large amounts of digital medical data to improve patient care and clinician workflows. I took a gap year during my studies between 3rd & 4th year to work as Healthcare Technology Fellow at Google Health Research division, which was a part of the Google Brain team at that time. During that year, I worked with a team to use audio and language models to extract medical information from doctor-patient conversation audio and transcripts with the goal of constructing a medical note to reduce clinical documentation burden.

I pursued anesthesiology residency in the Bonica Scholars research track at the University of Washington with a research focus in applying natural language processing (NLP) techniques to clinical notes to predict a patient's perioperative risk. During this time I was co-advised by Dr. Vikas O'Reilly-Shah (Pediatric Anesthesiology, Clinical Informatics) and Dr. Meliha Yetisgen (Biomedical Informatics, Linguistics). My research showed it is possible to predict American Society of Anesthesiologists Physical Status (ASA-PS) from only clinical notes to approximate a patient's illness severity. Furthermore, explanations for which snippets of note text the model used to arrive at these predictions were logical and easily interpreted by clinicians.

B. Positions, Scientific Appointments and Honors

Licensure

2023-2025 Medical Board of California (#A184257)
2019-2023 Washington State Department of Health (#ML60953456)

Positions and Scientific Appointments

2023 - present Postdoctoral Fellow & Clinical Scholar, Anesthesiology, Perioperative & Pain Medicine, Stanford University, Stanford, CA

2019 - 2023	Resident Physician & Bonica Research Scholar, Anesthesiology & Pain Medicine, University of Washington, Seattle, WA
2017 - 2018	Healthcare Technology Fellow, Google Research, Mountain View, CA
2014 - 2016	Engineering Project Director, Roy Laboratory, UCSF, San Francisco, CA
2011 - 2014	Research Engineer, Roy Laboratory, UCSF, San Francisco, CA
2010 - 2011	Graduate Student Researcher, Roy Laboratory, UCSF, San Francisco, CA
2010 - 2010	Graduate Student Instructor, Department of Bioengineering, UC Berkeley, Berkeley, CA
2009 - 2011	Graduate Student Instructor, Department of Chemistry, UC Berkeley, Berkeley, CA
2007 - 2010	Research Assistant, Wildsoet Laboratory, UC Berkeley School of Optometry, Berkeley, CA

Other Experience and Professional Memberships

2023 - present	Member, American Medical Informatics Association
2023 - present	Member, Society of Technology in Anesthesia
2017 - present	Member, American Society of Anesthesiologists
2014 - present	Member, American Medical Association
2014 - present	Member, Institute of Electrical and Electronic Engineers
2008 - present	Member, Tau Beta Pi Engineering Honor Society
2007 - 2011	President (2009-2010), Bioengineering Honor Society at UC Berkeley
2006 - 2010	Member, Biomedical Engineering Society

Honors & Awards

2022	Awardee, UW eScience Institute Microsoft Azure Cloud Compute Credits Grant
2022	Honorable Mention, University of Washington Anesthesia Department Academic Evening
2017	Winner, Kaiser Permanente Medical Student Scholarship
2016	Finalist, Paul and Daisy Soros Fellowship for New Americans
2011	Winner, UC Berkeley Venture Labs Competition
2010	Recipient, Andrew S. Grove Graduate Fellowship
2009	Winner, Alumni Leadership Award Scholar at UC Berkeley
2006	Recipient, UC Berkeley Regents' and Chancellor's Scholar

C. Contributions to Science

1. Low-cost Medical Device Development and Clinical Studies for Preterm Birth Detection. My early research focused on the development of new low-cost medical devices for the detection of preterm birth by using electrical and optical methods to assess cervical ripening across gestation. In addition to exploring the feasibility of this technology, these publications also explored device development techniques that could decrease the cost of research and manufacturing of devices to make these technologies feasible in a global health context as preterm birth rates are highest in low-resourced economies in Africa, Southeast Asia, but also paradoxically in the United States. My role was the principal engineer leading development of the technology, and later I also served as project manager to also coordinate clinical research logistics and global health partnerships.

    a. **Chung P**, Heller JA, Etemadi M, Ottoson PE, Liu JA, Rand L, Roy S. Rapid and low-cost prototyping of medical devices using 3D printed molds for liquid injection molding. J Vis Exp. 2014 Jun 27;PubMed PMID: 24998993; PubMed Central PMCID: PMC4208739.

    b. Etemadi M, **Chung P**, Heller JA, Liu JA, Rand L, Roy S. Towards BirthAlert--A Clinical Device Intended for Early Preterm Birth Detection. IEEE Trans Biomed Eng. 2013 Dec;60(12):3484-93. PubMed PMID: 23893706; PubMed Central PMCID: PMC4605421.

    c. Etemadi M, **Chung P**, Heller JA, Liu J, Grossman-Kahn R, Rand L, Roy S. Novel device to trend impedance and fluorescence of the cervix for preterm birth detection. Conf Proc IEEE Eng Med Biol Soc. 2013;2013:176-9. PubMed PMID: 24109653; PubMed Central PMCID: PMC4606960.

2. Mobile Health and Wearable Devices. Another theme in my early research career has been the use of mobile devices and custom wireless sensors to monitor treatment efficacy and disease progression. Clinicians often do not know exactly when treatment failure occurs or when a disease process worsens and often see patients months or years after the consequences of treatment failure become obvious. The digital health tool we developed helped remotely identify when treatment failure or disease progression occurs and allow clinicians to more effectively adjust treatment parameters in a timely fashion. Specific applications of the technology were explored in an orthodontic retainer, dynamic chest bracing for pectus carinatum correction, and for in-hospital monitoring of decubitus ulcers. My role was that of principal or lead electronics/software engineer in these projects.

    a. Castle E, **Chung P**, Behfar MH, Chen M, Gao J, Chiu N, Nelson G, Roy S, Oberoi S. Compliance monitoring via a Bluetooth-enabled retainer: A prospective clinical pilot study. Orthod Craniofac Res. 2019 May;22 Suppl 1:149-153. PubMed PMID: 31074131.
    b. Thatipelli S, Arun A, **Chung P**, Etemadi M, Heller J, Kwiat D, Imamura-Ching J, Harrison M, Roy S. Review of existing brace adherence monitoring methods to assess adherence. Journal of Prosthetics and Orthotics. 2016 October 01; 28(4):126-135.
    c. Harrison B, Stern L, **Chung P**, Etemadi M, Kwiat D, Roy S, Harrison MR, Martinez-Ferro M. MyPectus: First-in-human pilot study of remote compliance monitoring of teens using dynamic compression bracing to correct pectus carinatum. J Pediatr Surg. 2016 Apr;51(4):608-11. PubMed PMID: 26700692.
    d. **Chung P**, Rowe A, Etemadi M, Lee H, Roy S. Fabric-based pressure sensor array for decubitus ulcer monitoring. Conf Proc IEEE Eng Med Biol Soc. 2013;2013:6506-9. PubMed PMID: 24111232; PubMed Central PMCID: PMC4606918.

3. Natural Language Processing and Perioperative Machine Learning. Since medical school, my research focus has shifted to improving patient safety, outcomes, and clinical care workflow using the large repositories of data collected in the electronic health record (EHR). Significant volumes of clinical data is documented as free-form text notes and is not easily accessible via traditional machine learning techniques, leading to underutilization this rich data source. I have applied transformer deep learning models like BERT to clinical notes for the prediction of ASA-PS. This work has been recognized at multiple clinical conferences with manuscript currently in review. I am currently exploring the use of LLMs such as GPT-4 for perioperative risk stratification and outcomes prognostication.

    a. **Chung P**, Fong CT, Walters AM, Yetisgen M, O'Reilly-Shah VN. Prediction of American Society of Anesthesiologists Physical Status Classification from Preoperative Clinical Text Narratives Using Natural Language Processing. medRxiv 2023.02.03.23285402; doi:10.1101/2023.02.03.23285402 *(preprint, manuscript in-review)*
    b. **Chung P,** Yetisgen M, O'Reilly-Shah VN. Comparison Of Machine Learning Approaches For Predicting ASA Physical Status Classification From Pre-operative History Of Present Illness Text. American Society of Anesthesiology Annual Meeting, October 2022
    c. **Chung P,** Fong CT, O'Reilly-Shah VN. Natural Language Processing Predicts ASA Physical Status Classification from Pre-operative Note Text. Society of Critical Care Anesthesiologists Annual Meeting, May 2021
    d. **Chung P,** Fong CT, O'Reilly-Shah VN. Natural Language Processing Predicts ASA Physical Status Classification from Pre-operative Note Text. Association of University Anesthesiologists Annual Meeting, May 2021
    e. **Chung P**, Fong CT, O'Reilly-Shah VN. Natural Language Processing Predicts ASA Physical Status Classification from Pre-operative Note Text. International Anesthesia Research Society, May 2021.
    f. **Chung P,** Fong CT, O'Reilly-Shah VN. Automated ASA Physical Status Classification Prediction from History of Present Illness. Western Anesthesia Residents Conference, May 2021

Complete List of Published Work in MyBibliography:
https://www.ncbi.nlm.nih.gov/myncbi/philip.chung.1/bibliography/public/

D. Additional Information: Research Support and/or Scholastic Performance

Recent research support

Ongoing Research Support

NIGMS T32 GM089626-13 — Clark (PI) — 8/1/2023-8/1/2024

Research in Anesthesia Training Program (ReAP)

The T32 program at Stanford University is designed to train leaders in academic anesthesia and provides salary and research support to trainees devoted to anesthesiology research.

Role: Awardee

Completed Research Support

Microsoft Azure Cloud Computing Credits Grant – University of Washington eSciences Institute — Chung (PI) — 2/1/2022-6/30/2023

Automating Pre-Surgical Risk Assessment with Natural Language Processing

The goal of this project was to identify how well a perioperative patient's illness severity can be predicted using only free-text clinical notes and analyze whether model prediction explanations are logical to a physician. This project also compares the performance of several model types and note sections used for prediction.

Role: Principal Investigator