Albert K. Liu, Ph.D.

liualbertk@gmail.com

EDUCATION

University of California, Davis: September 2018-September 2023

- Doctor of Philosophy in Biochemistry, Molecular, Cellular, and Developmental Biology
- Thesis: "Retracing the evolution of rubisco oligomeric state"
- National Institutes of Health T32 Chemical Biology Trainee
- P.I.: Dr. Patrick Shih

University of Arizona: August 2014-May 2018

- Bachelor of Science in Molecular & Cellular Biology, Minor in Biochemistry
- Graduated May 2018, *magna cum laude* (GPA: 3.752)
- Thesis: "Lip2-Gcv3 Interaction in Yeast Lipoic Acid Synthesis"

POSITIONS

University of California, Berkeley: August 2021-Present

- Postdoctoral Scholar, Department of Plant & Microbial Biology: September 2023-Present
- Affiliate, Department of Plant & Microbial Biology**:** August 2021-September 2023

UC Davis Innovation Institute for Food and Health: August 2022-August 2023

- Science Communication Fellow

Innovative Genomics Institute: August 2022-February 2023

- Graduate Student Writer

Lawrence Berkeley National Laboratory: June 2019-June 2023

- Affiliate, Environmental Genomics and Systems Biology Division

University of Arizona Undergraduate Biology Research Program: June 2017-May 2018

- Undergraduate Biology Research Program Fellow, Department of Molecular & Cellular Biology

UC Davis Health: June-August 2015

- Hugh Edmondson Research Intern, Department of Pathology

CERTIFICATIONS

Certificate in Science Communication

- Issuer: CIERA – Northwestern University (https://ciera.northwestern.edu/programs/scope/)
- Issued: September 2022

COMMUNICATIONS EXPERIENCE

Science Communication Fellow

- UC Davis Innovation Institute for Food and Health, August 2022-August 2023
- Prepared briefs summarizing IIFH White Papers and Market Discovery Reports
- Created and managed content highlighting IIFH research and activities for Twitter and LinkedIn distribution
- Composed Medium posts translating IIFH White Papers and Market Discovery Reports for a broader, non-technical audience

Graduate Student Writing Fellow

- Innovative Genomics Institute, August 2022-February 2023
- Researched and composed article providing background on photosynthesis and discussing IGI engineering efforts funded by the Chan-Zuckerberg Initiative
- Interviewed IGI principal investigators Krishna Niyogi and David Savage, and researchers for perspectives on their ongoing research projects

PUBLICATIONS

Deep-branching evolutionary intermediates reveal structural origins of form I rubisco. ***Current Biology*** **(in review)**

- Albert K. Liu*, Benjamin Kaeser*,Lin-Xing Chen, Jacob West-Roberts, Leah J. Taylor-Kearney, Adi Lavy, Damian Günzing, Wen-Jun Li, Michal Hammel, Eva Nogales, Jillian F. Banfield, Patrick M. Shih

Carbon isotope fractionation by an ancestral rubisco suggests that biological proxies for CO_2 through geologic time should be reevaluated. ***Proceedings of the National Academy of Sciences*** **120, e2300466120 (2023).**

- Renée Z. Wang, Robert J. Nichols, Albert K. Liu, Avi I. Flamholz, Juliana Artier, Doug M. Banda, David F. Savage, John M. Eiler, Patrick M. Shih, and Woodward W. Fischer

A Bacterial Form I' Rubisco Has a Smaller Carbon Isotope Fractionation than Its Form I Counterpart. ***Biomolecules*****, 13(4), 596 (2023)**

- Renée Z. Wang, Albert K. Liu, Douglas M. Banda, Woodward W. Fischer and Patrick M. Shih

Structural plasticity enables evolution and innovation of rubisco assemblies. ***Science Advances*** **8, eadc9440 (2022)**

- Albert K. Liu, Jose H. Pereira*, Alexander J. Kehl*, Daniel J. Rosenberg*, Douglas J. Orr*, Simon K.S. Chu, Douglas M. Banda, Michal Hammel, Paul D. Adams, Justin B. Siegel, Patrick M. Shih

Novel bacterial clade reveals origin of form I Rubisco. ***Nature Plants*** **1–9 (2020)**

- Douglas M. Banda, Jose H. Pereira*, Albert K. Liu*, Douglas J. Orr, Michal Hammel, Christine He, Martin A. J. Parry, Elizabete Carmo-Silva, Paul D. Adams, Jillian F. Banfield & Patrick M. Shih

PRESENTATIONS

CO2 Assimilation in Plants from Genome to Biome Gordon Research Conference: May 2023

- Invited speaker – Advances in Photosynthesis Research section
- Structural plasticity enables evolution and innovation of rubisco assemblies (PowerPoint)

2023 Western Photosynthesis Conference: April 2023

- Structural plasticity enables evolution and innovation of rubisco assemblies (PowerPoint)
- Awarded Agrisera Best Student Talk Prize

BMCDB Spring Showcase Keynote Speaker: April 2023

- Retracing the evolution of form II rubisco (PowerPoint)

2023 Chemical Biology Program Retreat: March 2023

- Structural plasticity enables evolution and innovation of rubisco assemblies (Poster)

LBNL SIBYLS/BCSB/MBC Group Meeting: October 2022

- Structural plasticity enables evolution and innovation of rubisco assemblies (PowerPoint)

LBNL Berkeley Center for Structural Biology Participating Research Team Meeting: September 2022

- Structural plasticity enables evolution and innovation of rubisco assemblies (PowerPoint)

UC Berkeley Department of Plant and Microbial Biology Retreat: September 2022

- Structural plasticity enables evolution and innovation of rubisco assemblies (Poster)

Innovative Genomics Institute Poster Session Social: July 2022

- Structural plasticity enables evolution and innovation of rubisco assemblies (Poster)

Brookhaven National Laboratory Center for BioMolecular Structure Workbench: June 2022

- Retracing the evolution of form II rubisco (PowerPoint)

Chemical Biology in the Bay Area Day 2022: May 2022

- Retracing rubisco evolution reveals plasticity of oligomerization (PowerPoint)

DOE-BER Review of LBNL Integrated Diffraction Analysis Technologies: April 2022

- Investigating the evolution of form II rubisco with SEC-SAXS-MALS (PowerPoint)

UC Davis Chemical Biology Innovation Group: December 2021

- Retracing the evolution of form II rubisco (PowerPoint)

LBNL Biosciences Area Science Town Hall: November 2021

- Investigating the evolution of rubisco assemblies (PowerPoint)

UC Berkeley Department of Plant and Microbial Biology Retreat: September 2021

- Investigating the evolution of form II rubisco (PowerPoint)

2021 Advanced Light Source User Meeting BioSAXS Workshop: August 2021

- Investigating the evolution of form II rubisco (PowerPoint)

2020 Advanced Light Source User Meeting BioSAXS Workshop: August 2020

- Analysis of RuBisCO Oligomeric State by SEC-SAXS-MALS (PowerPoint)

UC Davis Biology Undergraduate Scholars Program Bio Bootcamp: September 2019

- Structurally-Guided RuBisCO Engineering Inspired by Novel Metagenomic Protein (PowerPoint)

2019 Chemical Biology Program Retreat: September 2019

- Structurally-Guided RuBisCO Engineering Inspired by Novel Metagenomic Protein (Poster)

University of Arizona Foundation *The Patron* Newsletter: May 2018

- (Interview)

2018 Undergraduate Biology Research Program Conference: January 2018

- Investigating the physical interaction of two proteins in the lipoic acid biosynthetic pathway (Poster)

KXCI Community Radio "Thesis Thursday": August 2017

- Thesis Thursday-Albert Liu (Interview)
- https://kxci.org/podcast/thesis-thursday-albert-liu/

UC Davis Health, Hugh Edmondson Intern Presentations: August 2015

- Application of Raman Spectroscopy For Single Cell Interrogation (PowerPoint)

RESEARCH

Investigation of additional form I rubisco-adjacent evolutionary intermediates: October 2019-Present

- UC Davis, BMCDB Ph.D. Candidate
- Heterologously expressed and purified two additional form I'' and I''' rubisco enzymes
- Conducted SEC-SAXS-MALS analysis to identify solution state oligomeric assemblies
- Conducting cryo-EM structural determination in collaboration with Nogales Lab (UC Berkeley)
- Lab of Patrick Shih, Ph.D.

Retracing form II rubisco evolution: June 2020-August 2022

- UC Davis, BMCDB Ph.D. Candidate
- Characterized oligomeric states of 28+ form II rubisco proteins by SEC-SAXS-MALS
- Structurally characterized novel tetrameric rubisco by X-ray crystallography and SEC-SAXS-MALS
- Conducted mutagenesis experiments to abolish hexameric rubisco assemblies
- Lab of Patrick Shih, Ph.D.

Structural characterization of novel form I' rubisco clade: March 2019-August 2020

- UC Davis, BMCDB Ph.D. Student
- Characterized novel form I' clade rubisco proteins via X-ray crystallography, SEC-SAX-MALS, and negative staining EM
- Conducted site-directed mutagenesis to introduce stabilizing contacts from Form I' enzyme into Form I rubisco
- Conducted Protein Thermal Shift experiments to quantify enzyme thermal stability
- Lab of Patrick Shih, Ph.D.; P.I. Doug Banda, Ph.D.

Lip2-Gcv3 interaction in yeast lipoic acid synthesis: September 2016-May 2018

- University of Arizona, Undergraduate Biology Research Program Fellow
- Conducted research on physical interaction between *Saccharomyces cerevisiae* mitochondrial fatty acid synthesis II pathway proteins Lip2 and Gcv3
- Verified presence of Gcv3-containing complex formed in high glycine environment
- Extracted and purified mitochondrial proteins for SDS-PAGE, Blue Native, and silver staining gel analysis
- Lab of Carol Dieckmann, Ph.D.

Evaluating single cell Raman spectroscopy as a diagnostic tool for *C. difficile* infection: June-August 2015

- UC Davis Health, Department of Pathology Hugh Edmondson Intern
- Attempted to determine the effectiveness of non-invasive Raman spectroscopy in diagnosing *Clostridium difficile* infection progression
- Utilized laser tweezers Raman spectroscopy to isolate and identify individual *C. difficile* cells for vegetative state vs. spore form determination
- Lab of James Chan, Ph.D.; P.I. Maria Navas-Moreno, Ph.D.

Single cell Raman spectroscopy of *E. coli* types: June-August 2015

- UC Davis Health, Department of Pathology Hugh Edmondson Intern
- Tested sensitivity of Raman spectroscopy in identifying *E. coli* genetic mutants
- Preliminary analysis identified detectable chemical differences between parent and mutant *E. coli* strains
- Lab of James Chan, Ph.D.; P.I. Dan Bricarello, Ph.D.

SCHOLARSHIPS AND FUNDING

- IIFH Science Communication Fellowship: 2022-23
- NIH T32 Chemical Biology Training Grant: 2019-20, 2021-22
- UC Davis Academic Excellence Scholarship: 2018-2019
- Arizona Excellence Tuition Award: 2014-2018
- Galileo Circle Scholarship: 2017-2018
- Asian Pacific State Employees Association Scholarship: 2014

HONORS AND AWARDS

- 2023 Western Photosynthesis Conference Agrisera Best Student Talk: 2023
- Galileo Circle Scholar: 2017, 2018
- Undergraduate Biology Research Program Fellow: 2017-2018
- University of Arizona Dean's List: Fall 2014-Fall 2017
- University of Arizona Academic Year Academic Distinction: 2015-2017

MENTORING

Alex Kehl: January 2021-Present

- Graduate Student, Shih Lab
- Presently Biophysics Ph.D. Candidate at UC Davis

Alyssa Marinas: March 2019-June 2020

- Undergraduate Research Assistant, Shih Lab
- Presently Research Associate at NoniGenex, Inc.

Rick Callado: March 2019-June 2020

- Undergraduate Research Assistant, Shih Lab
- Presently Microbial Lab Technician at Twin Arbor Labs

ACTIVITIES AND OUTREACH

UC Davis Caring for Chemists Guest Facilitator: February 2022

- Facilitated and mediated mental health discussion session for UC Davis Chemistry undergraduates, shared graduate school experiences and stress management strategies

BMCDB Recruitment: February 2022

- Hosted prospective recruit during virtual interview process, answered questions regarding graduate school experiences

UC Davis Teen Biotech Blogging Challenge Judge: April 2021

- Viewed and scored biotech-themed blogs from high school students in Environmental Biotechnology and Planetary Health category

BMCDB Recruitment: February 2021

- Organized and facilitated virtual social hour activity, answered questions regarding graduate school experiences

MCB 396i Guest Speaker: August 2020

- University of Arizona MCB 396i: Career Exploration and Professional Development

- Discussed undergraduate research experiences and transition to graduate school, answered questions regarding preparations for graduate school applications

First Year Aggie Connection Guest Speaker: February 2020

- Discussed graduate school application and experiences, answered questions about finding laboratory research opportunities

BMCDB Recruitment: February 2020

- Hosted prospective recruit during interview process, answered questions regarding graduate school experiences, assisted in guiding tours of UC Davis facilities

BMCDB Annual Colloquium Planner: September 2019

- Organized and set up poster session, assisted with award nomination

BMCDB Recruitment: February 2019

- Hosted prospective recruit during interview process, answered questions regarding graduate school experiences, assisted in guiding tours of UC Davis facilities

Bioethics Preceptorship: January 2017-May 2018

- Provided individual guidance and feedback to students, managed conflict during group assignments and discussions, graded assignments and exams, assisted instructor in miscellaneous tasks

UBRP Ambassador June 2017-May 2018

- Assisted in planning events, panels, and direction of the program, engaged other UBRP fellows and student researchers
- Participated in interview with UA Foundation representative to discuss program and research significance

Meet MCB Participant: October 2017

- Assisted with tour of UA MCB laboratories by visiting high school students
- Discussed undergraduate research, academic studies, and college life with prospective students

RELEVANT LABORATORY SKILLS

- Protein purification: AKTA, immobilized metal affinity chromatography
- Heterologous protein expression: *E. coli* transformation, liter-scale culture growth
- Gel electrophoresis: SDS-PAGE, Native PAGE
- Molecular cloning, site-directed mutagenesis

RELEVANT COURSEWORK

UC Davis

- Molecular Genetic & Genomics, Macromolecular Structure & Interactions, Cell Biology, Molecular Biology, Graduate Reading Course (Stem Cell Emphasis), Introduction to Chemical Biology, Mechanistic Enzymology

University of Arizona

- Molecular Genetics, Cell & Developmental Biology, The Biology of Cancer, Cancer Discoveries, Organic Chemistry I & II, Fundamentals in Biochemistry, Metabolic Biochemistry, Biostatistics, Bioethics