Christian B. Macdonald, Ph.D.
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Education

University of California, San Francisco — **San Francisco, CA**
Postdoctoral Scholar — September 2021 –
Advisors: Dr. James Fraser & Dr. Willow Coyote-Maestas

University of Michigan — **Ann Arbor, MI**
Ph.D., Biophysics — 2015 – August 2021
Advisor: Dr. Randy Stockbridge
Thesis: "Complexity in the Membrane"

Arizona State University — **Tempe, AZ**
B.S., Biochemistry *summa cum laude* — 2011 – 2015
B.S., Math, *summa cum laude* — 2011 – 2015
Advisors: Dr. George Pettit and Dr. Xu Wang
Honors thesis: "Total Synthesis of Dolastatin 16 and the Silstatins: Cyclic Depsipeptides from the Sea"

Publications

Jingyou Rao, Ruiqi Xin†, **Christian Macdonald**†, Matthew Howard, Gabriella O. Estevam, Sook Wah Yee, Mingsen Wang, James S. Fraser, Willow Coyote-Maestas, Harold Pimentel (2024). Rosace: a robust deep mutational scanning analysis framework employing position and mean-variance shrinkage. *Genome Biology* 25, 138. doi:10.1186/s13059-024-03279-7

Matthew K. Howard, Nicholas Hoppe, Xi-Ping Huang, **Christian B. Macdonald**, Eshan Mehrota, Patrick Rockefeller Grimes, Adam Zahm, Donovan D. Trinidad, Justin English, Willow Coyote-Maestas, Aashish Manglik. (2024). Molecular basis of proton-sensing by G protein-coupled receptors. *bioRxiv (preprint)*. doi:10.1101/2024.04.17.590000

Sook Wah Yee†, **Christian B. Macdonald**†, Darko Mitrovic† (equal contributions), Xujia Zhou, Megan L Koleske, Jia Yang, Dina Buitrago Silva, Patrick Rockefeller Grimes, Donovan Trinidad, Swati S More, Linda Kachuri, John S Witte, Lucie Delemotte, Kathleen M Giacomini, Willow Coyote-Maestas (2024). The full spectrum of SLC22 OCT1 mutations illuminates the bridge between drug transporter biophysics and pharmacogenomics. *Molecular Cell* 84, 10. doi:10.1016/j.molcel.2024.04.008

Gabriella O. Estevam, Edmond M. Linossi, **Christian B. Macdonald**, Carla A. Espinoza, Jennifer M. Michaud, Willow Coyote-Maestas, Eric A. Collisson, Natalia Jura, James S. Fraser (2023). Conserved regulatory motifs in the juxtamembrane domain and kinase N-lobe revealed through deep mutational scanning of the MET receptor tyrosine kinase domain. *bioRxiv (preprint)*. doi:10.1101/2023.08.03.551866v1

Christian B. Macdonald, David Nedrud, Patrick Rockefeller Grimes, Donovan Trinidad, James S. Fraser, Willow Coyote-Maestas (2023). Deep Insertion, Deletion, and Missense Mutation Libraries for Exploring Protein Variation in Evolution, Disease, and Biology. *Genome Biology* 24, 36. doi:10.1186/s13059-023-02880-6

Olive E. Burata, Trevor Justin Yeh, **Christian B. Macdonald** and Randy B. Stockbridge (2022). Still rocking in the structural era: a molecular overview of the Small Multidrug Resistance (SMR) transporter family. *Journal of Biological Chemistry* 298, 102482. doi:10.1016/j.jbc.2022.102482

Ali A. Kermani† and **Christian B. Macdonald**† (equal contributions), Olive Burata, B. Ben Koff, Akiko Koide, Eric Denbaum, Shohei Koide and Randy B. Stockbridge (2020). The structural basis of promiscuity in small multidrug resistance transporters. *Nature Communications* 11, 6064. doi:10.1038/s41467-020-19820-8

Ali A. Kermani, **Christian B. Macdonald**, Roja Gundepudi, and Randy B. Stockbridge (2018). Guanidinium export is the primal function of SMR family transporters. *Proceedings of the National Academy of Sciences* 115, 3060-3065. doi:10.1073/pnas.1719187115

Christian B. Macdonald and Randy B. Stockbridge (2017). A topologically diverse family of fluoride channels. *Current Opinion in Structural Biology* 45, 142-149. doi:10.1016/j.sbi.2017.04.003

George R. Pettit, Pablo M. Arce, Jean-Charles Chapuis, and **Christian B. Macdonald** (2015). Antineoplastic Agents. 600. From the South Pacific Ocean to the Silstatins. *Journal of Natural Products.* 78, 510-523. doi:10.1021/np501004h

George R. Pettit, Thomas H. Smith, Pablo M. Arce, Erik J. Flahive, Collin R. Anderson, Jean-Charles Chapuis, Jun-Ping Xu, Thomas L. Groy, Paul E. Belcher, and **Christian B. Macdonald** (2015). Antineoplastic Agents. 599. Total Synthesis of Dolastatin 16. *Journal of Natural Products.* 78, 476-485. doi:10.1021/np500925y

Talks

Molecular Mechanisms in Evolution Gordon Research Conference **2019**
"A shared non-canonical substrate facilitates the evolution of drug export in the Small Multidrug Resistance (SMR) family of transporters" (15 minute selected talk)

Biophysics Program Symposium, University of Michigan **2019**
"Evolving with promiscuous substrates in the small multidrug resistance family"

Selected Posters

Christian B. Macdonald, James Fraser, Willow Coyote-Maestas. **2022**

Illuminating trafficking and function of a potassium channel with a novel deep mutational scanning library
Ligand Recognition and Molecular Gating Gordon Research Conference

Christian B. Macdonald, Alexis Kelley*, Jenna Pellegrino, Willow Coyote-Maestas, James Fraser. **2022**
Using deep mutational scanning to identify the determinants of antibiotic resistance.
Biophysical Society 66th Annual Meeting

Alexis Kelley*, **Christian B. Macdonald**, James Fraser. **2022**
Dismantling antibiotic resistance one variant at a time: In vitro and computational analysis of VatD
Biophysical Society 66th Annual Meeting

Christian B. Macdonald, Troy Cao*, and Randy Stockbridge. **2021**

Evolution of inverted repeats in membrane transporters.
Biophysical Society 65th Annual Meeting

Troy Cao*, **Christian B. Macdonald**, and Randy B. Stockbridge. **2020**
Understanding the evolution of inverted repeats using the Fluc family of proteins.
Biophysical Society 64th Annual Meeting

**: mentored student author*

Awards

Mary Anne Koda-Kimble Seed Award for Innovation **2023**
Krimm Exceptional Dissertation Award **2021**
Program in Biomed. Sci. 20th Anniversary Excellence in Research Award **2019**
Poster award - Society of General Physiologists 72nd Annual Symposium **2018**

Fellowships

F32 Kirschstein NRSA Fellowship (NIH/NIGMS) **2023-**
NSF Graduate Research Fellowship Program - Honorable mention **2016**
Maas Fellowship - University of Michigan **2015**

Teaching

University of California, San Francisco
Peer Review in the Life Sciences **2023**
Co-instructor

University of Michigan
BIOPHYS 440: Biophysics of Diseases **2017, 2018**
Guest lecturer
BIOPHYS 454: Biophysical Chemistry II **2017**
Guest lecturer
BIOPHYS 420: Structural Biology I **2017**
Graduate student instructor. Created material and taught ancestral reconstruction module.
BIOPHYS 120: Mysteries of the Double Helix **2016**
Graduate student instructor.
BIOPHYS 440: Biophysics of Diseases **2015**
Graduate student instructor. Created lecture material and taught NMR module.

Service

DEI journal club organizer **2022-**
Reviewer **2021-**

- BBA - General Subjects
- Biophysical Chemistry
- eLife (Early-career reviewer in Structural Biology and Molecular Biophysics)
- Nature
- Nature Communications
- Protein Science

Head steward, UAW 5810 **2021-2023**
Department steward, GEO 3550 **2017 - 2018**
Organizer, NMR journal club and NMR workshop **2016 - 2017**
Graduate student representative **2016 - 2017**

Training

Evidence-Based Teaching Course (STEP-UP) **2022**
Inclusive Research Mentor Course **2022**

Inclusive STEM Teaching Project **2021**
Nanion Surfe^{2}R N1 Research Grant **2018**
University of Minnesota Advanced NMR Workshop **2016**

Mentorship

University of California, San Francisco

Sonya Lee, Junior Specialist **2022-**

Alexis Kelley, UCSF PROPEL post-baccalaureate researcher **2021-2022**
Currently: PhD student, Biophysics, Johns Hopkins University

University of Michigan

Fox Baudelaire, Pathways Master's student **2021**
Currently: PhD student, MCDB, University of Michigan

Vivek Parikh, Undergraduate honors thesis **2021**
"Topological evolution of the Small Multidrug Resistance (SMR) family of Transporters"
Currently: University of Virginia School of Medicine

Troy Cao, Undergraduate honors thesis **2019**
"Towards Understanding the Evolution of Dual-Topology Membrane Proteins: Examining The Flucs, a Family of Fluoride Ion Channels"
Currently: Ohio State University College of Medicine