

Elaine Kirschke, Ph.D.

ekirschke@ucsb.com

SUMMARY

In my 15 years+ of experience in biological research, I have successfully executed a diverse set of research projects in both academia and industry, in fields ranging from protein folding, gene regulation, to plant physiology. This has included experimental studies spanning the molecular, cellular, tissue, and even whole organism level. In the process I have acquired extensive training and experience spanning many aspects of the scientific discovery process with an emphasis on unraveling biomolecular mechanisms.

EDUCATION

- University of California, San Francisco, Ph.D, Biophysics 2007-2014
- University of California, Santa Barbara, B.S., Biochemistry with Physics Minor 2002-2006

RESEARCH AND PROFESSIONAL EXPERIENCE

University of California, Santa Barbara, Assistant Project Scientist 2023-present
Department of Chemical Engineering and Institute for Collaborative Biosciences
Supervisor: Michelle O'Malley

- **Projects:** TBD
- **Methodologies:** TBD

Apeel Sciences, Senior Scientist I/II 2019-2023
Biological Sciences (2019-2022), Apeel Labs (2022), Product Development (2022-2023)

- **Projects:** Executed research for various projects both independently and collaboratively investigating physiological state of plants and produce during various supply chains in the context of Edipeel treatments and various other experimental treatments (antifungal compounds e.g.).
- **Methodologies:** RNA extraction from plant tissue, RNA quality assessment (Tapestation), RNA-seq library generation and data analysis, plant and produce physiology measurements, *Arabidopsis* cultivation, fruit antifungal studies

University of California, San Francisco, Helen Hay Whitney Postdoctoral Fellow 2015-2019
Department of Cellular and Molecular Pharmacology
Advisor: Keith Yamamoto

- **Project:** Investigate the mechanism and function for the dynamics of transcription regulatory complexes as it relates to eukaryotic gene regulation.
- **Methodologies:** RT-qPCR, high-throughput liquid handling, cell culture, sub-cellular fractionation, westerns, Chromatin Immunoprecipitation (ChIP), CRISPR/Cas9 genome editing (mammalian cell line)

University of California, San Francisco, Jr. Specialist Jan-Jul 2015
Departments of Biochemistry and Biophysics
Advisor: David Agard

- **Project:** High resolution structural study of substrate bound Hsp90:Hsp70 chaperone complexes
- **Methodologies:** size exclusion chromatography with inline multiangle light scattering (SEC-MALS), Cryo-EM

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University of California, San Francisco, Graduate Student

2007-2014

Graduate Group in Biophysics

Advisor: David Agard

- **Project:** Mechanistic biochemical studies investigating how the molecular chaperones Hsp70 and Hsp90 (with co-chaperones) regulate hormone binding of the glucocorticoid receptor (GR). Biochemistry was complimented by structural investigations, including acquisition of a low resolution cryo-EM structures of GR bound chaperone complexes.
- **Methodologies:** cloning, protein expression and purification, biochemistry, fluorescence anisotropy, FRET, westerns, enzyme kinetics, analytical gel filtration, SEC-MALS, small angle x-ray scattering

University of California, Santa Barbara, Research Assistant

Jan-Sep 2007

Department of Chemistry and Biochemistry

Advisor: Luc Jaeger

- **Project:** Structural evolution study of the RNA eleven-nucleotide GNRA tetraloop-binding receptor motif
- **Methodologies:** *in vitro* transcription, radioisotope labeling, RNA assembly, electrophoretic mobility shift assay (EMSA)

University of Washington, Seattle, NSF-NNIN REU

Jun-Aug 2006

Department of Microbiology

Advisor: Beth Traxler

- **Project:** Engineered proteins for binding and organization of inorganic particles for applications in nanotechnology
- **Methodologies:** cloning, western blot

Hoag Cancer Center, New Port Beach, Summer Research Intern

Jun-Aug 2004

Advisor: Patric Schiltz

- **Project:** Characterization of dendritic cells generated *in vitro* using different media formulations for applications in immunotherapy
- **Methodologies:** cell culture, flow cytometry

PUBLICATIONS

Kirschke E., Goswami D., Southworth D., Griffin P.R., Agard D., "Glucocorticoid Receptor Function Regulated by Coordinated Action of the Hsp90 and Hsp70 Chaperone Cycles." *Cell* (2014)

Morgner N., Schmidt C., Beilsten-Edmands V., Ebong I.I., Patel N., Clerico E.M., Kirschke E., Daturpalli S., Jackson S., Agard D., Robinson C., "Hsp70 Forms Antiparallel Dimers Stabilized by Post-translational Modifications to Position Clients for Transfer to Hsp90" *Cell Rep* (2015)

Kirschke E., Elnatan D., Verba K., and Agard D., "Chapter 6: Structural Insight into Hsp90 Function" In: Structure and Action of Molecular Chaperones, Horwich A. ed., Series in Structural Biology (Anders Liljas ed.), Vol 6, *World Scientific Publishing* (2016)

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Kirschke E., Roe-Zurz Z., and Agard D., "Comparison of Hsp90 and Bag-1 reveals inhibition of Hsp70 rebinding by Hsp90 as essential for Glucocorticoid Receptor activity" *BioRxiv* (2020)

Wang R., Noddings C., Kirschke E., Myasnikov A., Johnson J., Agard D., "Structure of Hsp90-Hsp70-Hop-GR reveals the Hsp90 client-loading mechanism." *Nature* (2021)

TECHNICAL SKILLS

Molecular Biology:

- Over 10 years of experience utilizing general molecular biology procedures including PCR, cloning, mutagenesis etc., in which I have generated over 100 different constructs including constructs for recombinant bacterial expression and repair templates for Cas9 genome editing utilizing homology directed repair mechanisms.
- 3 years of experience with RT-qPCR including primer design, primer validation, RNA extraction, and scaling RT-qPCR to a semi-high-throughput work flow utilizing the Labcyte Echo Acoustic Liquid handler.
- 2 years of experience designing and executing experiments utilizing RNA-seq for differential gene expression and navigating genomic tools for non-model organisms.

Biochemistry:

- 7 years of experience in rigorous large-scale protein purification, in which I have purified and characterized over a dozen different proteins. This involved developing new purification strategies for notoriously challenging protein targets and frequent maintenance and use of AKTA FPLCs.
- 6 years of experience in assay development for rigorous mechanistic dissection of multicomponent protein systems. This included utilizing enzyme kinetics and fluorescent based assays such as fluorescence anisotropy and FRET to characterize protein-protein, protein-ligand, and protein-DNA interactions. Investigations encompassed equilibrium and kinetic binding experiments under different concentration regimes to determine kinetic rates, equilibrium constants, and binding stoichiometries to obtain a comprehensive mechanistic understanding of biological pathways.
- Related data analysis skill includes curve fitting to complex equations using R and KaleidaGraph.

Structural Biology:

- 6 years of experience forming, stabilizing, and characterizing multi-protein complexes for structural characterization. This included protein complex analysis by SEC-MALS and trapping protein complexes utilizing specific mutations and chemical crosslinking strategies. As a graduate student, I maintained the SEC-MALS equipment and assisted researchers from across the university in carrying out SEC-MALS.
- I have a strong theoretical understanding and hands-on experience with many structural techniques including x-ray crystallography, small angle x-ray scattering, and negative stain and cryo-EM.

HONORS, AWARDS, AND FUNDING

- NSF Grant #1817891- 2018
Title: Dynamics of transcriptional regulatory complexes: Mechanism and function
- Hellen Hay Whitney Foundation Postdoctoral Fellowship- 2016
- American Cancer Society Postdoctoral Fellowship (declined)- 2016

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- Clements Distinguished Thesis Award (UCSF Biophysics)- 2014
- Best Poster Award- UCSF Biophysics, Bioinformatics and Chemical Biology Retreat- 2013
- UCSF Quantitative Biosciences Consortium Merit Fellowship- 2012
- Best Poster Award- UCSF Biophysics, Bioinformatics and Chemical Biology Retreat- 2012

SELECT ORAL PRESENTATIONS

- Clements Lecture, University of California San Francisco- 2014
- CSHL Meeting: Conference on Molecular Chaperones & Stress Response- 2014
- Ignite Bay Area Dynamics (iBAD), University of California San Francisco- 2014

SELECT POSTER PRESENTATIONS

- Breakthrough Prize in Life Sciences, Stanford University- 2014
- FASEB Protein Folding in the Cell- 2014
- 6th Conference on The Hsp90 Chaperone Machine. Switzerland- 2012
- Bay Area Cryo EM Meeting. University of California Santa Cruz- 2012
- HHMI Science Meeting in Translational Medicine- 2012
- 5th Conference on The Hsp90 Chaperone Machine, Switzerland- 2010