

# Matthew R. Hennefarth

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## Education

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University of California, Los Angeles

March 2020

B.S. Chemistry, Concentration in Physical Chemistry  
with Departmental Highest Honors

B.S. Pure Mathematics

with College Honors and Latin Honors (*summa cum laude*)

Overall GPA: 3.97

## Research Experience

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Staff Scientist

April 2020 — Present

Undergraduate Research Scholar

Sept 2018 — March 2020

*University of California, Los Angeles*, Department of Chemistry and Biochemistry

Principle Investigator: Anastassia N. Alexandrova, ana@chem.ucla.edu

- Develop new methods to quantify and probe a protein's locally produced electric field to determine its electrostatic preorganization
- Rewrote a distributable version of our mixed QM/DMD software for proteins, PHD3 (Protein Hybrid Discrete Dynamics/DFT), that includes a titratable feature
- Perform QM calculations to investigate the preferential binding of histidine and cations to phospholipid head groups over lysine to determine the mechanism by which anti-microbial proteins function
- Utilize Quantum Theory of Atoms in Molecules to analyze critical points of the electron density within enzyme active sites and looking for differences which correspond to changes in the electrostatic preorganization

Research Fellow

May 2016 — Jan 2019

*University of California, San Francisco*, School of Dentistry

Principle Investigator: Sunita P. Ho, Sunita.Ho@ucsf.edu

- Investigated possible cellular and mechanical mechanisms by which Peyronie's plaque is manifested using advanced correlative microscopy techniques
- Used 3D image analysis in Avizo, and light and fluorescent microscopy techniques to create spatial-temporal maps of extracellular matrix and intracellular proteins
- Performed elemental analysis and electron diffraction experiments at the Advanced Light Source in Lawrence Berkeley National Laboratory

Undergraduate Research Assistant

Sept 2017 — June 2018

*University of California, Los Angeles*, Department of Chemistry and Biochemistry

Principle Investigator: Carla Koehler, koehler@chem.ucla.edu

- Assisted in various molecular biology techniques including zebrafish genotyping and plasmid sequencing to create protein KO lines
- Collaborated with the CNSI for high resolution fluorescent microscopy analysis of key proteins within the primary motor neuron mitochondria
- Coded python scripts to quantify fluorescent images of various zebrafish KO lines using ImageJ

## Publications

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- i. Xian, W.; **Hennefarth, M.R.**; Lee, M.W.; et al. "Hofmeister Meets Marine Innate Immunity: Ion-Specific Sidechain Interactions Enable Salt-Tolerance in an Antimicrobial Peptide." (Submitted).
- ii. **Hennefarth, M.R.**; Alexandrova, A.N. "Heterogeneous Intramolecular Electric Field as a Descriptor of Diels-Alder Reactivity." (Submitted, chemRxiv.13266704).
- iii. **Hennefarth, M.R.**; Alexandrova, A.N. "Direct Look at the Electric Field in Ketosteroid Isomerase and its Variants." *ACS Catalysis* **2020**, *10* (17), 9915-9924. DOI:10.1021/acscatal.0c02795.
- iv. Reilley, D.J.; **Hennefarth, M.R.**; Alexandrova, A.N. "The Case for Enzymatic Competitive Metal Affinity Methods." *ACS Catalysis* **2020**, *10* (3), 2298-2307. DOI:10.1021/acscatal.9b04831.
- v. **Hennefarth, M.R.**; Chen, L.; Wang, B.; et al. "Physicochemical and Biochemical Spatiotemporal Maps of a Mouse Penis." *Journal of Biomechanics* **2020**, *101*. DOI:10.1016/j.jbiomech.2020.109637.
- vi. Liberty, F.; Jahanbakhsh, S.; Ray, D.; Nelson, A.; Scott, D.; **Hennefarth, M.R.**; et al. "A Chemical Biology Approach to Model Pontocerebellar Hypoplasia Type 1B (PCH1B)." *ACS Chemical Biology* **2018**, *13* (10), 3000-3010. DOI:10.1021/acschembio.8b00745.

## Conference Abstracts and Presentations

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**Hennefarth, M.R.**; Alexandrova, A.N. "Quantifying Perturbations in the Local Electric Field in Ketosteroid Isomerase." (Presented at the UCLA Undergraduate Research Showcase, 2020)

Chen, L.; **Hennefarth, M.R.**; Kang, M.; et al. "PD44-04 The spatial distribution of inorganic nanoparticles within calcified Peyronie's plaque." *The Journal of Urology* (2018). (Presented by Dr. Sunita P. Ho at the annual AUA conference, 2018)

**Hennefarth, M.R.**; Chen, L.; Hsi, R.; et al. "MP56-18 The mouse corpus cavernosum glandus is biomechanically analogous to the human corpus cavernosum." *The Journal of Urology* (2017). (Presented at the annual AUA conference, 2017)

**Hennefarth, M.R.**; Chen, L.; Kang, M.; et al. "PD31-11 The origins of calcified Peyronie's plaque." *The Journal of Urology* (2017). (Presented by Dr. Sunita P. Ho at the annual AUA conference, 2017)

## Awards

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<b>Dolores Cannon Southam Commencement Award for Excellence in Research</b>	June 2020
<b>UCLA Undergraduate Research Scholar</b>	Sept 2019
<b>Daniel Kivelson Undergraduate Research Fellowship</b>	March 2019
<b>Dean Honor List</b>	Dec 2016 — March 2020

## Teaching and Services

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**Finance Directory, Los Angeles Student Education Outreach** Sept 2016 — March 2020  
Mentor and tutor at-risk middle school students at Berendo Middle School in Los Angeles. Apply for funding to ensure proper funding for all of the organizations activities.

**Organic Chemistry Learning Assistance, UCLA** April 2018 — Aug 2019  
Facilitated student learning by encouraging active dialogue in problem solving in organic chemistry. Create practice problems for discussion sections as well as create and lead the final review session.

## Skills

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**Technical Skills:** Electron microscopy (field emission and scanning transmission), energy dispersive X-ray spectroscopy, immunohistochemistry, light and fluorescent microscopy, X-ray fluorescent spectroscopy, chemical simulations with TURBOMOLE, Gaussian, and  $\pi$ DMD

**Coding Languages:** Python, C++, Bash, Java