Antoine Koehl

akoehl@berkeley.edu | (530) 848-6530 | https://antoinekoehl.github.io

Education

Ph.D., Structural Biology 2019
Stanford University

B.S., Molecular, Cell, and Developmental Biology 2013
University of California, Los Angeles

Research And Professional Experience

Postdoctoral Fellow 2023 – Present
UC Berkeley - jointly advised by Yun S. Song and David F Savage

- **NIGMS K99 Project Title:** Leveraging machine learning and evolution to navigate sequence-function landscapes in multidomain proteins

Miller Fellow 2020 – 2023
UC Berkeley, Hosted by Yun S. Song

- **Miller Proposal:** Using protein language models to learn sequence/structure/function relationships

Graduate Student 2013 – 2019
Stanford University, lab of Brian Kobilka

- **Thesis Title:** Structural insights into G protein-coupled receptor activation and signaling

Amgen Scholar 2012
Caltech, lab of André Hoelz

Academic Honors

K99/R00 Pathway to Independence Award Dec 2023 – Present
NIH/NIGMS

Miller Research Postdoctoral Fellowship 2020–2023
Miller Institute for Basic Research in Science

CGS/Proquest Distinguished Dissertation Award Finalist 2019
Single nominee from Stanford University, national finalist

Amgen Scholarship 2012

Preprints

1. **Koehl A∗**, Prillo, S∗, Liu M, Wang, L, and Song Y S. Deep Models of Protein Evolution in Time. *In review at NeurIPS*
2. Fung A, **Koehl A∗†**, Jagota M, Song YS. The Impact of Protein Dynamics on Residue-Residue Coevolution and Contact Prediction. *bioRxiv* 2022:2022.10.16.512436.

Publications

1. Yu J, Zhang X, Martin C, Van Holsbeeck K, Raia P, **Koehl, A**, Laearemans T, Steyaert J, Manglik A, Ballet S, Boland A, Stoeber M. Structural basis of μ-opioid receptor targeting by a nanobody antagonist. *Nature Communications* (2024).
2. Krishna Kumar K, Wang H, Habrian C, Latorraca NR, Xu J, O'Brien ES, Zhang C, Montabana E, **Koehl A**, Marqusee S, Isacoff EY, Kobilka, BK. Stepwise activation of a metabotropic glutamate receptor. *Nature* (2024). https://doi.org/10.1038/s41586-024-07327-x.
3. Jagota M, Ye C, Albors C, Rastogi R, **Koehl A**, Ioannidis N, et al. Cross-protein transfer learning substantially improves disease variant prediction. *Genome Biology* (2023);24:182. https://doi.org/10.1186/s13059- 023-03024-6
4. Koleske ML, McInnes G, Brown JEH, Thomas N, Hutchinson K, Chin MY, **Koehl A**, Arkin MR, Sch- lessinger A, Gallagher RC, Song YS, Altman RB, Giacomini KM. Functional genomics of OCTN2 variants informs protein-specific variant effect predictor for Carnitine Transporter Deficiency. *Proc Natl Acad Sci USA* (2022);119:e2210247119
5. **Koehl A∗**, Jagota M, Erdmann-Pham DD, Fung A, Song YS. Transferability of Geometric Patterns from Protein Self-Interactions to Protein-Ligand Interactions. *Pac Symp Biocompu* (2022);27:2233.

6. Chavan, T.S., Cheng, R.C., Jiang, T, Mathews, I.I., Stein, R.A., **Koehl, A.**, Mchaourab, H.S., Tajkhor- shid, E, Maduke, M. A CLC-ec1 mutant reveals global conformational change and suggests a unifying mechanism for the CLC Cl −/H+ transport cycle *Elife* (2020);9:e53479

7. **Koehl A∗**, Hu, H., Feng, D., Sun, B., Robertson, M. J., Chu, M., Kobilka, T. S., Laeremans, T., Steyaert, J., Tarrasch, J., Dutta, S., Fonseca, R., Weis, W. I., Mathiesen, J. M., Skiniotis, G. Kobilka, B. K. Structural insights into the activation of metabotropic glutamate receptors. *Nature* 566, 79-84 (2019)

    - Highlighted, faculty of 1000: https://archive.connect.h1.co/article/734907329/

8. Maeda, S., **Koehl, A**., Matile, H., Hu, H., Hilger, D., Schertler, G. F. X., Manglik, A., Skiniotis, G., Dawson, R. J. P. Kobilka, B. K. Development of an antibody fragment that stabilizes GPCR/G-protein complexes. *Nature Communications* 9, 3712 (2018)

9. **Koehl A∗**, Hu, H., Maeda, S., Zhang, Y., Qu, Q., Paggi, J. M., Latorraca, N. R., Hilger, D., Dawson, R., Matile, H., Schertler, G. F. X., Granier, S., Weis, W. I., Dror, R. O., Manglik, A., Skiniotis, G. Kobilka, B. K. Structure of the μ-opioid receptor-Gi protein complex. *Nature* 558, 547-552 (2018).

10. Schmidt, H. R., Zheng, S., Gurpinar, E., **Koehl, A.**, Manglik, A. Kruse, A. C. Crystal structure of the human σ-1 receptor. *Nature* 532, 527-530 (2016).

11. AhYoung, A. P., **Koehl, A∗**., Vizcarra, C. L., Cascio, D. Egea, P. F. Structure of a putative ClpS N-end rule adaptor protein from the malaria pathogen Plasmodium falciparum. *Protein Science* 25, 689-701 (2016).

12. Lyubimov, A. Y., Murray, T. D., **Koehl, A**., Araci, I. E., Uervirojnangkoorn, M., Zeldin, O. B., Cohen, A. E., Soltis, S. M., Baxter, E. L., Brewster, A. S., Sauter, N. K., Brunger, A. T. Berger, J. M. Capture and X-ray diffraction studies of protein microcrystals in a microfluidic trap array. *Acta Crystallogr. D Biol* Crystallogr. 71, 928-940 (2015).

13. AhYoung, A. P., **Koehl, A∗**, Cascio, D. Egea, P. F. Structural mapping of the ClpB ATPases of Plas- modium falciparum: Targeting protein folding and secretion for antimalarial drug design. *Protein Science*. 24, 1508-1520 (2015).

(∗ = co-first author, † = co-corresponding author)

Conference Presentations/Talks

UC Berkeley CCB Retreat 2024
Talk: Deep Models of Protein Evolution

MCB Postdoc Lunch Club Fellowship Panel 2024
Panelist - fellowship applications

UC Davis Biophysics Seminar Series 2023
Invited talk: Using Protein Language Models to Understand Sequence/Structure Relationships

Miller Symposium 2023
Poster: Protein Language Models Reveal Structure/Function Relationships

Miller Symposium 2022
Poster: Hierarchical Modeling of Protein Families

Pacific Symposium on Biocomputing 2021
Accepted talk: Transferability of Geometric Patterns from Protein Self-Interactions to Protein-Ligand Interactions

GPCR Workshop 2017
Poster: Structure of the μ-opioid receptor-Gi protein complex

Chan Zuckerberg Biohub Inter-lab Confab #2 2017
Poster: Structure of the μ-opioid receptor-Gi protein complex

GPCR Workshop 2015
Poster: Structural Studies of a μ-Opioid Receptor- Gi protein Complex

Amgen Scholar Symposium 2012
Talk: Structure of the nuclear pore complex

Outreach

El Cerrito High School Science Outreach 2022–2023
Presented research and interest in science in an interactive way to science students in 9-12 grade at a predominantly minority student high school

Recruitment Chair, BioAIMS 2015–2017
Responsible for organizing the BioAIMS recruitment prescence during graduate admissions at Stanford

Conference/Seminar Organization

Miller Symposium Committee 2022–2023

Curating list of speakers, invites, coaching of speakers to present at the interdisciplinary symposium

MCP Seminarian 2017

Responsible for inviting a speaker for the monthly Stanford MCP seminar series and coordinating the selection and invitation of the Feigen Lecture speaker with other seminarians in department

References

1. Yun S Song, Ph.D. (yss@berkeley.edu)
2. David F Savage, Ph.D. (savage@berkeley.edu)
3. Brian K Kobilka, M.D. (kobilka@stanford.edu)
4. Susan Marqusee, M.D., Ph.D. (marqusee@berkeley.edu)
5. Aashish Manglik, M.D., Ph.D. (aashish.maglik@ucsf.edu)