‘

Sonoma CA
alxcarln@gmail.com
(707) 695-2592

ALEX CARLIN

Education

Ph.D., Biophysics, University of California, Davis, 2017

Led large team to develop high quality enzyme function traning sets for protein ML

B.A., Biology, Bard College, 2010

X-ray crystallography and molecular simulation, protein design

Jobs

Ginkgo Bioworks, Senior Protein Engineer, 2021–2023

— Architected and developed software stack for protein design (DevOps, software)
— Executed deep learning experiments to improve protein structure transformer models
— Led dataset curation and developed business-critical protein design benchmarks
— Worked with software and cloud engineers to scale protein LLMs to trillions of tokens
— Trained and mentored scientists at PhD level in deep learning

Ginkgo Bioworks, Protein Engineer, 2017–2021

— Scaled GPU bioinformatics, molecular modeling, and ML workflows on AWS
— Enzyme design and discovery using novel deep learning tools I developed
— Developed new functionality in deep learning models for protein discovery
— Molecular modeling of enzyme–transition state complexes

UC Davis Genome Center, Graduate Student Researcher (2013–2017)

— Data sets of solubility, expression, and catalysis for 100s of proteins in heterologous hosts
— Original research in protein engineering tools and algorithms
— Rational design and directed evolution of enzymes for targeted specificity profile
— Enzyme design algorithm development (Python, C++)
— Worked with industry (Transcriptic) to automate and scale assays

Bouchaine Vineyards, Lab Tech, Winemaking (2012)

— Large-scale (200–20,000 L) microbial culture (*Oenococcus*, *Saccharomyces*)
— Enzyme assays, natural products chemistry, sensory analysis

Conn Creek Winery, Lab Tech, Analytical Chemistry (2011)

University of Maryland, College Park, Research Assistant (2010)

— Engineering of fungal enzymes for enhanced catalysis on tick cuticle
— Culture, transformation, enzyme expression in fungi (*Metarhizium, Aspergillus*)

Bard College. Teaching Assistant, Organic Chemistry (2009)

Patents

Ginkgo Bioworks, Inc., assignee. Biosynthesis of cannabinoids and cannabinoid precursors. US2021/0071209A1

Synlogic Operating Company, Inc. & Ginkgo Bioworks, Inc., assignee. Optimized bacteria engineered to treat disorders involving the catabolism of leucine, isoleucine, and/or valine. WO2020/257610A1

Ginkgo Bioworks, Inc., assignee. Biosynthesis of cannabinoids and cannabinoid precursors. WO2021/034848A1

Ginkgo Bioworks, Inc. & Synlogic Operating Company, Inc., assignee. Biosynthesis of enzymes for use in treatment of Maple Syrup Urine Disease (MSUD). WO2020/257707A1

University of California, Davis, assignee. Engineered bacteria for the production of n-butanol. WO2015/191611A1

Papers

Peer-reviewed publications

Li N, Tucker A, Gao JR, Renaud L, James M, Castillo M, Galvan S, Jain R, Putman R, Marr S, **Carlin DA**, Zimmerman K, Stone LK, Bergeron C, Perreault M, Boyle P, Kurtz C. Development of an engineered probiotic for the treatment of branched chain amino acid related metabolic diseases. *Research Square* (preprint); 2021. DOI: 10.21203/rs.3.rs-318620/v1.

Freund GS, O'Brien TE, Vinson L, **Carlin DA**, Yao A, Mak WS, Tagkopoulos I, Facciotti MT, Tantillo DJ, Siegel JB. Elucidating Substrate Promiscuity within the FabI Enzyme Family. *ACS Chemical Biology*. 2017 Aug 18.

Desjardins M, Mak WS, O'Brien T, **Carlin DA**, Tantillo D, Siegel JB. Systematic functional analysis of active site residues in L-threonine dehydrogenase from *Thermoplasma volcanium*. *ACS Omega*. 2017 Jul 7;2(7):3308-14.

Carlin DA, Hapig-Ward S, Chan BW, Damrau N, Riley M, Caster RW, Bethards

B, Siegel JB. Thermal stability and kinetic constants for 129 variants of a family 1 glycoside hydrolase reveal that enzyme activity and stability can be separately designed. *PloS one.* 2017 May 22;12(5):e0176255.

Vater A, Agbonavbare V, **Carlin DA**, Carruthers GM, Chac A, Doroud L, Farris SJ, and others. Draft genome sequences of *Shewanella* sp. strain UCD-FRSP16_17 and nine *Vibrio* strains isolated from abalone feces. *Genome Announcements.* 2016 Oct 27;4(5):e00977-16.

Carlin DA, Caster RW, Wang X, Betzenderfer SA, Chen CX, Duong VM, Ryklansky CV, Alpekin A, Beaumont N, Kapoor H, Kim N, Mohabbot H, Pang B, Teel R, Whithaus L, Tagkopoulos I, Siegel JB. Kinetic characterization of 100 glycoside hydrolase mutants enables the discovery of structural features correlated with kinetic constants. *PloS one.* 2016 Jan 27;11(1):e0147596.

Carlin DA, Bertolani SJ, Siegel JB. Biocatalytic conversion of ethylene to ethylene oxide using an engineered toluene monooxygenase. *Chemical Communications.* 2015 Jan 5;51(12):2283-5.

Rossi M, Caruso F, Crespi EJ, Pedersen JZ, Nakano G, Duong M, Mckee C, Lee S, Jiwrajka M, Caldwell C, Baffour F, **Carlin DA**, and others. Probing antioxidant activity of 2'-hydroxychalcones: crystal and molecular structures, in vitro antiproliferative studies and in vivo effects on glucose regulation. *Biochimie.* 2013 Oct 31;95(10):1954-63.

Book chapter

Bertolani SJ, **Carlin DA**, Siegel JB. Computational introduction of catalytic activity into proteins. *Methods in Molecular Biology* (Clifton, N.J.). 1414: 213-31

Talks

Invited talks

Toward data driven prediction of enzyme catalysis. Rosetta Commons "RosettaCon", Leavenworth, Washington, 7/17 (future)

Evaluating molecular modeling of enzymes by building large data sets of characterized variants. Biophysics Graduate Group Seminar Series, University of California, Davis, 2/17

Education and automation integrated into an engineering process for enzyme design. Rosetta Commons "RosettaCon", Leavenworth, Washington, 7/16.

Education and automation integrated into an engineering process for enzyme design. Chemical Biology Training Program Retreat, University of California, Davis, 6/16

Data-driven prediction of enzyme catalysis. Chemical Biology Innovation Group, University of California, Davis, 2/15

Meeting presentations

Evaluating molecular modeling of enzymes using machine learning tools. UC Davis Rosetta Users' Group, University of California, Davis, 5/17

Active site engineering of oleate hydratase targeting ethylene activity. Advanced Research Projects Agency–Energy (ARPA-E) Energy REMOTE Program Team Meeting, La Jolla, CA, 6/16

Education and automation integrated into an engineering process for enzyme design. UC Davis Rosetta Users' Group, University of California, Davis, 2/16

Biocatalytic conversion of ethylene to ethylene oxide using an engineering toluene monooxygenase. DOE Advanced Research Projects Agency–Energy (ARPA-E) Energy Innovation Summit, Washington DC, 6/15

Mentoring

Mentor, UC Davis Young Scholars Program, 2013-2016

Mentor, UC Davis iGEM Team (engineered enzyme biosensors), 2015

Mentor, Davis Senior High School Biotechnology Program, 2014-2017

Skills

Dry lab tools

Training and improving deep neural networks

Massive-scale bioinformatics and structure prediction

Data science (Python ML stack)

Molecular modeling and design (Rosetta, PyMOL, open source tools)

Cluster and cloud computing (GPU clusters, AWS, Kubernetes)

Scientific software design and ergonomics

Wet lab tools

Lab automation (HTP assay design for workcells)

Protein biochemistry (expression, purification, analysis, HTP assay)

Molecular genetics (NGS, mutagenesis for protein engineering)

Analytical biochemistry (HPLC, GC-FID, UV-vis spectroscopy)