

Elly Poretsky, PhD

Computational Biologist
Postdoctoral Fellow

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Summary

I'm a biologist and bioinformatician with expertise in plant immunity, comparative genomics, and computational protein methods. I received my Ph.D. from UC San Diego where I characterized a maize anti-herbivory receptor, peptide hormones, and specialized metabolism pathways. In my current USDA post-doc position, I apply state-of-the-art methods in protein structure prediction and protein language models to improve functional annotation, including work on machine learning phosphorylation predictions, protein-protein interactions, and protein-ligand interactions. I strive for reproducible and open science, making my work accessible through GitHub, Colab and Docker.

Education

University of California, San Diego
The Open University, Israel

2015-2021 Ph.D. Biology
2010-2014 B.S. Biology

Experience

- 2023 – **Post-doctoral SCINet Fellow, GrainGenes Group**
US Department of Agriculture, Western Regional Research Center, Albany, CA
- Developed a ML model for phosphorylation prediction with protein language models
 - Developed an analysis framework for predicted pan-interactome networks
 - Studying enzyme-ligand interaction using molecular docking and dynamic simulation
 - Apply LangChain with ChatGPT to automate GWAS result curation from PDFs
- 2021 – 22 **Post-doctoral Researcher, Schmelz Lab**
Biological Sciences, UC San Diego, La Jolla, CA
- Extracted and analyzed maize root terpenoid specialized metabolites
 - Analyzed maize root microbiome data and conducted antimicrobial assays
 - Comparative analysis of transcriptomic, metabolomic and GWAS data (>200 lines)
- 2015 – 21 **Ph.D. Student, Huffaker Lab**
Biological Sciences, UC San Diego, La Jolla, CA
- Characterized a GWAS candidate receptor for anti-herbivory in maize
 - Characterized a family of maize peptide hormones and their CRISPR KO receptors
 - Developed a coexpression analysis web-app for metabolomic pathway elucidation
- 2014 – 15 **Research Assistant, Schroeder Lab**
Biological Sciences, UC San Diego, La Jolla, CA
- Implemented a stomatal bioassay for measuring ABA-induced responses
 - Used confocal microscopy to measure FRET-based ABA reporters
 - Propagated and genotyped Arabidopsis KO-lines involved in ABA-signaling

Skills

Computing: Python, R, Bash, Slurm, Docker, Google Colab, Snakemake, git, SQL

Bioinformatics:

Proteins: Structure prediction and alignment, protein language models features and homology, small molecule docking, confirmation prediction, molecular dynamic simulation

Transcriptomics: HISAT2, BWA-MEM, gene coexpression analysis, enrichment analysis

Genomics: BLAST, DIAMOND, HMMER, InterProScan, phylogeny, synteny, variant calling

Genetic mapping: QTL and GWAS, imputation, haplotype analysis, variant effect prediction

PlantApp.org: Constructed and hosted a comparative genomics database for plants

Statistics: Machine learning, GWAS, classical stats, linear and mixed models
Biochemistry: Protein extraction, western blotting, Co-IP, enzyme bioassays, protoplasting, VIGS
Molecular Biology: Cloning, DNA/RNA extraction, RT-PCR, Illumina sequencing
Analytical Chemistry: Metabolite extraction, GC-MS and GC-FID analysis, HPLC purification
Web-applications: Dash, Shiny and Jupyter Widgets

Funding and Awards

2016-18 NIH Cellular and Molecular Genetics Training Grant
2016 Helmsley Scholarship for a Cold Spring Harbor Laboratory workshop
2015-16 Graduate Assistance in Areas of National Need

Presentations

2024 Harnessing the predicted maize pan-interactome for putative gene function prediction and prioritization of candidate genes for important traits. **SCINet Fellows Conference**, Agricultural Research Center, Beltsville, MD
2023 PhosBoost: Predicting Plant Protein Phosphorylation using Protein Language Models and Gradient Boosting Trees. **Annual UC Systemwide Bioengineering Symposium**, UC Berkeley, CA
2021 Uncovering the Genetic Basis of Maize Sensitivity to Herbivore-Associated Fatty-acid Amino-acid Conjugates. **Annual Maize Genetics Conference**, online
2019 Uncovering the Genetic Basis of Maize Sensitivity to Herbivore-Associated Fatty-acid Amino-acid Conjugates. **Departmental Plant Talks Seminar**, UC San Diego, CA
2018 Within spitting distance: Zeroing in on how plants recognize herbivore attack. **Annual CMG Research Colloquium**, UC San Diego, CA

Publications

2024 **Poretsky E***, Cagirici HB*, Andorf CM, Sen TZ. Harnessing the predicted maize pan-interactome for putative gene function prediction and prioritization of candidate genes for important traits. **G3: Genes, Genomes, Genetics**
2023 **Poretsky E**, Andorf CM, Sen TZ. PhosBoost: Improved phosphorylation prediction recall using gradient boosting and protein language models. **Plant Direct**
2023 Saldivar EV, Ding Y, **Poretsky E**, Bird S, Block AK, Huffaker A, Schmelz EA. Maize terpene synthase 8 (ZmTPS8) contributes to a complex blend of fungal-elicited antibiotics. **Plants**
2022 Poosapati S, **Poretsky E**, Dressano K, Ruiz M, Vazquez A, Sandoval E, Estrada-Cardenas A, Duggal S, Lim JH, Morris G, Szczepaniec A, Walse SS, Ni X, Schmelz EA, Huffaker A. A sorghum genome-wide association study (GWAS) identifies a WRKY transcription factor as a candidate gene underlying sugarcane aphid (*Melanaphis sacchari*) resistance. **Planta**
2022 Murphy KM*, **Poretsky E***, Liu H, Micic N, Nyhuis A, Bohlmann J, Schmelz EA, Zerbe P, Huffaker A, Bjarnholt N. Shielding the oil reserves: the scutellum as a source of chemical defenses. **Plant Physiology**
2021 **Poretsky E**, Ruiz M, Ahmadian N, Steinbrenner AD, Dressano K, Schmelz EA, Huffaker A. Comparative analyses of responses to exogenous and endogenous antiherbivore elicitors enable a forward genetics approach to identify maize gene candidates mediating sensitivity to herbivore-associated molecular patterns. **The Plant Journal**
2020 **Poretsky E**, Dressano K, Weckwerth P, Ruiz M, Char SN, Shi D, Abagyan R, Yang B, Huffaker A. Differential activities of maize plant elicitor peptides as mediators of immune signaling and herbivore resistance. **The Plant Journal**
2020 **Poretsky E**, Huffaker A. MutRank: an R shiny web-application for exploratory targeted mutual rank-based coexpression analyses integrated with user-provided supporting information. **PeerJ**.

- 2020 Ding Y, Weckwerth PR, **Poretsky E**, Murphy KM, Sims J, Saldivar E, Christensen SA, Char SN, Yang B, Tong AD, Shen Z. Genetic elucidation of interconnected antibiotic pathways mediating maize innate immunity. **Nature Plants**
- 2020 Dressano K, Weckwerth PR, **Poretsky E**, Takahashi Y, Villarreal C, Shen Z, Schroeder JI, Briggs SP, Huffaker A. Dynamic regulation of Pep-induced immunity through post-translational control of defence transcript splicing. **Nature plants**
- 2019 Ding Y, Murphy KM, **Poretsky E**, Mafu S, Yang B, Char SN, Christensen SA, Saldivar E, Wu M, Wang Q, Ji L. Multiple genes recruited from hormone pathways partition maize diterpenoid defences. **Nature Plants**
- 2019 Fong SH, Carlin DE, Ozturk K, Ideker T, ... **Poretsky E**, Qin Y, Rideout D and Zhou J. Strategies for Network GWAS Evaluated Using Classroom Crowd Science. **Cell Systems**
- 2015 Brandt B, Munemasa S, Wang C, Nguyen D, Yong T, Yang PG, **Poretsky E**, Belknap TF, Waadt R, Alemán F, Schroeder JI. Calcium specificity signaling mechanisms in abscisic acid signal transduction in Arabidopsis guard cells. **Elife**

Teaching and Mentorship

- 2023 Protein Function and Phenotype Prediction (2-day workshop, USDA)
- 2022 Summer Training Academy for Research Success (STARS) program, UC San Diego
- 2021-22 Research Opportunity and Orientation for Transfer Students program, UC San Diego
- 2021-22 Mentored one Master's student, UC San Diego
- 2019 Instructional Assistant. BILD1 - The Cell, UC San Diego
- 2018 Summer Training Academy for Research Success (STARS) program, UC San Diego
- 2018 Instructional Assistant. BILD2 - Multicellular Life, UC San Diego
- 2017 Instructional Assistant. BIMM101 - Recombinant DNA Techniques, UC San Diego
- 2016-22 Mentored five visiting undergraduate summer students, UC San Diego
- 2016-17 Mentored two summer high school students, UC San Diego