

# Kelly Cochran

[kcochran@stanford.edu](mailto:kcochran@stanford.edu)

813 - 528 - 6353

[kellycochran.github.io](https://kellycochran.github.io)

## EDUCATION

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### Stanford University

Sep 2019 - Expected 2025

Ph.D. in Computer Science, advised by Dr. Anshul Kundaje

Pierre & Christine Lamond Fellow, Stanford Graduate Fellowship (2019 - 2022)

### Duke University

Aug 2014 - May 2018

B.S. in Computer Science; Minors in Statistics, Computational Biology & Bioinformatics

Angier B. Duke Memorial Full Merit Scholarship

## RESEARCH EXPERIENCE

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### Kundaje Lab - Stanford University

Sep 2019 - Current

*Ph.D Candidate, Computer Science*

- Dissected how DNA sequence encodes regulation of transcription initiation in humans by developing and interpreting ProCapNet, a state-of-the-art deep learning model
- As part of GENCODE consortium, leveraged ProCapNet to improve gene annotations
- Mentored several high school and undergraduate students through research projects
- Presented talk at ISMB 2023, poster at CSHL; 1<sup>st</sup>-author manuscript under review

### Mahony Lab - Pennsylvania State University

June 2018 - Aug 2019

*Research Tech, Center for Eukaryotic Gene Regulation*

- Trained neural networks to transfer prediction of transcription factor binding across species; diagnosed a novel source of model bias + corrected it using domain adaptation
- Presented talks at MLCB 2019, ISMB 2021; 1<sup>st</sup>-author publication in *Genome Research*

### Kay Lab - Duke University

Dec 2015 - May 2018

*Undergraduate Researcher, Neurobiology & Ophthalmology*

- Analyzed deep long-read RNA-seq data to identify 1000+ novel isoforms in neurons
- Developed an R package to characterize + visualize isoform diversity from PacBio data

### Wang Lab - University of California, Los Angeles

Summer 2017

- Developed a statistical test for Type II Diabetes from gut microbiome RNA-seq data

## PUBLICATIONS

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- Chen, Y., Shah, S.R., Leung, A., Paramo, M.I., **Cochran, K.**, Kundaje, A., Clark, A.G., Lis, J.T., Yu, H. 2024. **Directionality of transcriptional regulatory elements.** *bioRxiv*. Under review. [[Preprint](#)]
- Mudge, J.M., Carbonell-Sala, S., Diekhans, M., Gonzalez-Martinez, J., Hunt, T., Jungreis, I., Loveland, J.E., Arnan, C., Barnes, I., Bennett, R., Berry, A., Bignell, A., Cerdán-Vélez, D., **Cochran, K.**, Cortés, L.T., Davidson, C., Donaldson, S., Dursun, C., Fatima, R., Hardy, M., Hebbar, P., Hollis, Z., James, B.T., Jiang, Y., Johnson, R., Kaur, G., Kay, M., Mangan, R.J., Maquedano, M., Gómez, L.M., Mathlouthi, N., Merritt, R., Ni, P., Palumbo, E., Perteghella, T., Pozo, F., Raj, S., Sisú, C., Steed, E., Sumathipala, D., Suner, M., Uszczyńska-Ratajczak, B., Wass, E., Yang, Y.T., Zhang, D., Finn, R.D., Gerstein, M., Guigó, R., Hubbard, T.J.P., Kellis, M., Kundaje, A., Paten, B., Tress, M.L., Birney, E., Martin, F.J., Frankish, A. 2024. **GENCODE 2025: reference gene annotation for human and mouse.** *Nucleic Acids Research*. gkae1078. [[Paper](#)]
- Kaur, G., Perteghella, T., Carbonell-Sala, S., Gonzalez-Martinez, J., Hunt, T., Madry, T., Jungreis, I., Arnan, C., Lagarde, J., Borsari, B., Sisú, C., Jiang, Y., Bennett, R., Berry, A., Cerdán-Vélez, D., **Cochran, K.**, Vara, C., Davidson, C., Donaldson, S., Dursun, C., González-López, S., Das, S.G., Hardy, M., Hollis, Z., Kay, M., Montañés, J.C., Ni, P., Nurtdinov, R., Palumbo, E., Pulido-Quetglas, C., Suner, M., Yu, X., Zhang, D., Loveland, J.E., Albà, M.M., Diekhans, M., Tanzer, A., Mudge, J.M., Flicek, P., Martin, F.J., Gerstein, M., Kellis, M., Kundaje, A., Paten, B., Tress, M.L., Johnson, R., Uszczyńska-Ratajczak, B., Frankish, A., Guigó, R. 2024. **GENCODE: massively expanding the lncRNA catalog through capture long-read RNA sequencing.** *bioRxiv*. Under review. [[Preprint](#)]
- Cochran, K.**, Yin, M., Mantripragada, A., Schreiber J., Marinov, G., Shah, S.R., Yu, H., Lis, J.T., & Kundaje, A. 2024. **Dissecting the cis-regulatory syntax of transcription initiation with deep learning.** *bioRxiv*. Under review. [[Preprint](#)] [[Code](#)]
- Martyn, G.E., Montgomery, M.T., Jones, H., Guo, K., Doughty, B.R., Linder, J., Chen, Z., **Cochran, K.**, Lawrence, K.A., Munson, G., Pampari, A., Fulco, C.P., Kelley, D.R., Lander, E.S., Kundaje, A., Engreitz, J.M. 2023. **Rewriting regulatory DNA to dissect and reprogram gene expression.** *bioRxiv*. Under review. [[Preprint](#)]
- Cochran, K.**, Srivastava, D., Shrikumar, A., Balsubramani, A., Hardison, R.C., Kundaje, A., & Mahony, S. 2022. **Domain-adaptive neural networks improve cross-species**

**transcription factor binding prediction.** *Genome Research*. 32: pp. 512-523. [[Paper](#)] [[Code](#)]

Ray, T., **Cochran, K.**, Kozlowski, C., Wang, J., Alexander, G., Cady, M.A., Spencer, W.J., Ruzyski, P.A., Clark, B.S., Laeremans, A., He, M-X., Wang, X., Park, E., Hao, Y., Iannaccone, A., Hu, G., Fedrigo, O., Skiba, N.P., Arshavsky, V.Y., & Kay, J.N. 2020. **Comprehensive identification of mRNA isoforms reveals the diversity of neural cell-surface molecules with roles in retinal development and disease.** *Nature Communications*, 11(1): pp. 1-20. [[Paper](#)] [[Code](#)]

Ray, T., **Cochran, K.**, & Kay, J. 2019. **The enigma of *CRB1* and *CRB1* retinopathies.** In: Bowes Rickman C., Grimm C., Anderson R., Ash J., LaVail M., Hollyfield J. (eds) *Retinal Degenerative Diseases. Advances in Experimental Medicine and Biology*, vol 1185. Springer, Cham.

## CONFERENCE TALKS

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**Intelligent Systems For Molecular Biology (ISMB)**, Lyon, France July 2023  
- World's largest bioinformatics conference; 12% talk acceptance rate

**Symbolic Systems Forum**, Stanford, CA January 2022  
- Invited to give 1-hour presentation on research to Stanford undergraduates

**Intelligent Systems For Molecular Biology (ISMB)**, Virtual July 2021  
- Selected for 20-minute "Long Talk" + Poster

**Machine Learning in Computational Biology (MLCB)**, Vancouver, CA Dec 2019  
- Co-located with NeurIPS; 1 of 10 talks chosen from 118 submissions [[Video](#)]

**Great Lakes Biology Conference (GLBio)**, Madison, WI May 2019

## POSTER PRESENTATIONS

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**Cochran, K.**, Yin, M., Schreiber, J., & Kundaje, A. (July 2023). *Modeling the cis-regulatory syntax of transcription initiation with ProCapNet*. Presented at ISMB, Lyon, France.

**Cochran, K.**, Yin, M., Schreiber, J., & Kundaje, A. (May 2023). *Modeling the cis-regulatory syntax of transcription initiation with ProCapNet*. Presented at Biology of Genomes, Cold Spring Harbor Labs, NY.

**Cochran, K.**, Srivastava, D., Shrikumar, A., Balsubramani, A., Kundaje, A., & Mahony, S. (July 2021). *Domain-adaptive neural networks improve cross-species prediction of transcription factor binding*. Presented at Intelligent Systems for Molecular Biology (ISMB), virtually. [\[Video\]](#)

**Cochran, K.**, Srivastava, D., Balsubramani, A., Kundaje, A., & Mahony, S. (July 2019). *Cross-species transcription factor binding prediction using neural networks*. Presented at the Penn State Summer Symposium in Molecular Biology, State College, PA.

**Cochran, K.**, Ray, T., & Kay, J. (April 2018). *A bioinformatics pipeline for characterizing isoform diversity in PacBio sequencing data*. Presented at the Computer Science Undergraduate Project Showcase, Durham, NC.

Ray, T., **Cochran, K.**, & Kay, J. (January 2018). *Targeted sequencing and bioinformatics pipeline for capturing and characterizing isoform diversity*. Presented at the Duke University Research Computing Symposium, Durham, NC. **2<sup>nd</sup> Place Poster Award**.

**Cochran, K.**, Mitchell, D., Ju, C. J.-T., & Wang, W. (August 2017). *A genome-independent and alignment-free approach for improved disease prediction using k-mer counts from metagenomic reads*. Poster presentation for Bruins-in-Genomics Summer Research Fellowship program, Los Angeles, CA. **Best Poster Award**.

## RESEARCH MENTORING

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### Genomics Research Internship Program at Stanford (GRIPS)

Summer 2023

- Mentored 2 high school students through complex research projects; later integrated their contributions with authorship into ProCapNet manuscript (Cochran *et al.* 2024)

### Kundaje Lab High School Research Interns

Summers 2020 - 2022

- Close mentor to 3 students; organized intern selection; helped foster intern community

### CS197 TA / Research Mentor

Fall 2021

- Designed projects + advised 9 students in 3 groups; coached research skills - literature reviews, scientific writing, giving short talks; mentored underrepresented CS students

## SOFTWARE

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Choe, C., Wayment-Steele, H., **Cochran, K.**, Sharma, E., Kim, D.S., & Das, R. [authors unordered]. **RiboTree**: Software to Design Functional DNA & RNA Medicines.

Patented software. Featured in [Leppek et al. 2022](#): Combinatorial optimization of mRNA structure, stability, and translation for RNA-based therapeutics. [\[Access\]](#)

**Cochran, K. & Ray, T. IsoPops:** Framework for analyzing output of PacBio sequencing experiments. R package. Companion to Ray *et al.* 2020. [\[Docs\]](#)[\[Code\]](#)

## TEACHING EXPERIENCE

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### **CS109: Intro to Probability for Computer Scientists**, Stanford University

*Teaching Fellow (Co-Instructor / Instructor of Record)*

Summer 2024

- 2nd-year CS major course; topics from the basics up to ML, combining math + code
- Taught 11 lectures for 40 students, handled all course logistics including final grades, wrote majority of exams, and adjusted course to a shortened summer quarter
- Course eval feedback: "This class completely redefined the bar for me for what a "well-taught" class looks like."; "Kelly is an amazing instructor [...]. She is very clear, while also being funny and engaging, and her super high level of commitment to the course and the students is obvious." Avg. student rating for course overall: 4.5/5

*Head TA*

Fall 2023, Fall 2024, Winter 2025

- Managed 330-420 students + 15-20 TAs; handled all course logistics, taught a lecture, trained + mentored new TAs, led review sessions, revised exams, held office hours
- Applied Teaching-As-Research ideas to develop strategies for improved exam outcomes
- Student feedback: "one of the best TAs I've had", "exactly the TA I want to have"
- Other TA feedback: "seriously helped me grow as a teacher", "the GOAT"

*TA*

Fall 2022

- Led weekly discussion sections + office hours, wrote exam problems, graded assignments, and answered 200+ student questions online (most of any TA)

### **TA, CS197: Computer Science Research**, Stanford University

Fall 2021

- Led Computational Biology section, coaching 3 groups of 3 students through projects, teaching scientific writing/literacy, presentation skills, and best practices in the field
- Course targets undergraduates from underrepresented backgrounds in CS research
- Student feedback: "incredibly supportive", "dedicated", "very knowledgeable"

### **Co-Instructor, Unix & Python Virtual Workshops**, Stanford University

Fall 2020

- Co-taught a week-long virtual Intro Python workshop to 60+ biomedical researchers; student feedback: "The best online learning I've done in any setting", "You are a great teacher", "You made it so that Python was no longer overwhelming!"

- Prepared and led a 2-session Unix crash course for 1st-year Genetics Ph.D. students; feedback: “The best ‘unix basics’ that I’ve witnessed”

**Section Leader, Code-In-Place, Virtual**

Spring 2020

- Developed lessons for and taught a 10-person discussion group in a massive (~10,000 students) international virtual offering of Stanford’s CS106A Intro Python course

**TA, Software Design & Implementation, Duke University**

Spring 2017

- Advised students in regular code reviews, office hours, and lecture; graded projects

## TEACHING TRAINING

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**Evidence-Based Undergraduate STEM Teaching, Local Learning Community** Fall 2024

**Teaching-As-Research, Stanford Graduate Summer Institute**

Summer 2024

**IDEAL Pedagogy, Local Learning Community**

Winter 2024

## ACADEMIC SERVICE

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**Admissions, Stanford University**

- Evaluated 200+ applications while on CS Ph.D. Admissions Committee 2021
- CS DEI Applicant-Support Program volunteer (early application feedback) 2020 - 2021
- Volunteer for Admit Weekends’ DEI programming + as “comp-bio liaison” 2020 - 2022
- Alumni interviewer for Duke Undergraduate Admissions 2021

**Inclusion in AI, Stanford University**

2019 - 2021

- Co-organized bi-monthly Women in AI networking + support group and the Humans of AI speaker series, aimed at fostering more inclusive community in the CS department
- Organized and supported DEI advocacy within the CS department, working with faculty and staff, the DEI Committee, and the Grad Student Advisory Council

**Peer Review**

- Machine Learning In Computational Biology (MLCB) 2020 - 2024

- Genome Research 2024
- RECOMB (subreviewer) 2024
- Bioinformatics 2023 - 2024
- Intelligent Systems for Molecular Biology (ISMB) 2023 - 2024
- Springer Machine Learning 2023
- Asian Conference in Machine Learning (ACML) 2023
- Northern Lights Deep Learning (NLDL) 2023
- IEEE/ACM Transactions on Computational Biology and Bioinformatics 2022

## OTHER SERVICE & LEADERSHIP

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**Volunteer**, Pets-In-Need Palo Alto, CA Fall 2024 - Current

- Provide animal care support, socialize cats, and act as “Parking Commander”; 5 hrs/wk

**Assistant Band Director**, St. Ignatius College Prep, CA 2021 - 2023

- Helped found the “Spirit of SI” Pep Band program from scratch
- Coached new-to-band directors on athletic band management, logistics, and culture
- Mentored students in leadership roles; developed solid musical and social foundations

**Foster Volunteer**, Centre County PAWS, PA & Pets-In-Need Palo Alto, CA 2018 - 2020

- Fostered 10 cats and kittens; responsible for medical care and socialization

**Drum Major**, Duke University Marching Band 2016 - 2018

- Senior conductor, mentor, and academic tutor to 130+ band members, and a driving force behind organizational growth, both musically and as a community
- Received the Charles Hogan Memorial Band Award for “dedication, leadership, enthusiasm, and a willingness to serve the band”