

# Shruti Singh Kakan, MS, PhD

Stanford University, School of Medicine  
1651 Page Mill Rd  
Palo Alto, CA, 94304  
+1 626 541 5842

[shruti.singh.222@gmail.com](mailto:shruti.singh.222@gmail.com)  
<https://www.linkedin.com/in/shruti-kakan-phd/>  
<https://scholar.google.com/citations?user=Zecevn0AAAAJ&hl=en>  
<https://github.com/singhkakan>

## Summary

---

A Bioinformatician with 12 years of experience in life sciences research and expertise in Immunology, drug discovery & design, statistics and data visualizations. Successfully applied computational biology & RNA sequencing methods to develop In-Vitro Diagnostics for autoimmune diseases in pre-clinical models and human subjects.

## Research Experience

---

### Post-Doc Research Associate

USC Keck School of Medicine, Los Angeles

05/08/2024 – Present

- Validated potential tear biomarkers for Sjogren's Disease (SjD) across 2 mouse models using autoantibody microarrays leading to one peer reviewed publication (PMID: 39936155).
- Supervised 2 PhD students in the development of single-cell suspension protocols for scRNA-seq and flow cytometry to investigate immune regulation mechanisms in autoimmunity.

### Clinical Research Data Scientist – Consultant

mcSquared AI, San Francisco

04/29/2024 – 12/01/2024

- Generated preliminary data for NIH grants by analyzing genetic variation in Colorectal Carcinoma using the Cancer Genome Atlas (TCGA).
- Mined cancer literature to optimize feature selection & accuracy of 2 AI/ML models for identifying patients eligible for clinical trial and building LLMs application for targeted literature review of anti-cancer drug candidates.
- Served as Subject Matter Expert and guided 3 Data Engineers to build python pipelines to ingest Real World Data from IQVIA, Health Verity, Flatiron and TrinetX.

### Bioinformatician III

MantraBio Inc, San Francisco

04/24/2023 – 04/30/2024

- Enhanced analytical test development for Diabetic Retinopathy (DR) by creating bioinformatics pipelines to analyze 7 multi-omics datasets from humans and rodents, including bulk RNA-seq, single-cell RNA-seq, and proteomics data.
- Pitched and led collaborative projects for EV characterization using electron microscopy image analysis with 3 teams & CROs.
- Successfully built visualizations in R and performed statistical evaluation for 6 pre-clinical efficacy studies of EV therapeutics for DR.

### Post-Doc Research Associate

USC Keck School of Medicine, Los Angeles

02/20/2023 – 04/17/2023

- Guided 2 MS students in tear exosome research and immunoassays to validate omics-generated hypotheses regarding cytokine signaling in inflammation in mouse models of SjD, leading to journal publication (PMID: 37010857).
- Produced experimental evidence to support the targeting of soluble IL-6R alpha in inflammatory dry-eye disease for therapeutic development.

### Graduate Research Assistant

Mann School of Pharmacy & Keck School of Medicine, USC

08/14/2017 – 12/31/2022

- Led molecular diagnostics projects for SjD by generating genomics and antibody microarray datasets from 3 mouse models.

- Conducting bioinformatics analysis using Python, R and UNIX with HPC, resulting in 2 peer-reviewed publications.
- Created Python algorithm and succeeded in optimizing RAM usage and computational time for sequence alignment of small RNAseq data.
- Advanced collaborations for biomarker discovery & validation for Parkinson's Disease leading to 2 research grants.
- Optimized protocols for isolation and characterization of exosomes from biofluids, primary cultures & cell lines

### Research Assistant

Mann School of Pharmacy, USC

10/01/2015 – 07/31/2017

- Improved purification of thermo-responsive protein-polymers for targeted Cancer Drug Delivery of Rapamycin
- Conceptualized and developed 2 HPLC methods for quantitative assessment of drug encapsulation efficiency of protein-polymers.
- Applied HPLC methods to investigate drug-release kinetics of protein polymer leading to identification of sustained-release nature of Rapamycin encapsulated FKBP-ELP and subsequent co-authorship of 1 peer-reviewed research article.

### Research Assistant

Department of Pharmacy & Chemistry, BITS-Pilani, Hyderabad Campus

01/15/2011 – 06/01/2014

- Identified small-molecular hits targeting drug-resistant Tuberculosis (TB) using molecular docking.
- Synthesized three libraries of small-molecule compounds & tested their inhibition of enzymes specific to latent & drug-resistant TB, leading to 4 journal publications.
- Optimized the adsorption capacity of chitosan & graphene derived biodegradable polymers to adsorb heavy metals from industrial sewage, leading to 2 journal publications.

## Education

### University of Southern California

Los Angeles, CA

Doctor of Philosophy, Pharmaceutical & Translational Sciences (Bioinformatics) GPA: 3.85/4

12/14/2022

Dissertation: "*Exploring Serum & Tear microRNAs as Biomarkers for Early Diagnosis of Sjögren's Syndrome*"

### University of Southern California

Los Angeles, CA

Master of Science, Pharmaceutical Sciences. GPA: 3.95/4

08/08/2017

Thesis: "*Comparing drug release kinetics of rapamycin bound FKBP-ELP fusion proteins*"

### Birla Institute of Technology and Science (BITS) – Pilani

Hyderabad, India

Bachelor of Pharmacy (Honors) GPA: 8.32/10

02/22/2014

## Publications

### Peer-reviewed Journal Articles

- **Kakan SS**, Abdelhamid S, Ju Y, Edman-Woolcott M C, Mackay J A, Raman I, Chensong Z, Raj P, Hamm-Alvarez S F. "Serum and Tear Autoantibodies from NOD and NOR Mice as Potential Diagnostic Indicators of Local and Systemic Inflammation in Sjögren's Disease". (*Under Review* – *Frontiers in Immunology* 2024)
- **Kakan SS**, Li X, Edman MC, Okamoto C, Hjelm BE, Hamm-Alvarez, SF. The miRNA landscape of lacrimal glands in a murine model of autoimmune dacryoadenitis. *Investigative Ophthalmology & Visual Science*. 2023 April 4;64(4):1-13. PMID: 37010857
- **Kakan SS**, Edman MC, Yao A, Okamoto CT, Nguyen A, Hjelm BE, Hamm-Alvarez SF. Tear miRNAs identified in a murine model of Sjögren's syndrome as potential diagnostic biomarkers and indicators of disease mechanism. *Frontiers in Immunology*. 2022 Mar 4;13. PMID: 35309364
- **Kakan SS**, Janga SR, Cooperman B, Craig DW, Edman MC, Okamoto CT, Hamm-Alvarez SF. Small RNA Deep Sequencing Identifies a Unique miRNA Signature Released in Serum Exosomes in a Mouse Model of Sjögren's Syndrome. *Frontiers in Immunology*. 2020 Jul 17;11:1475. PMID: 32849505

- Edman MC, Janga SR, **Kakan SS**, Okamoto CT, Freire D, Feigenbaum D, Lew M, Hamm-Alvarez SF. Tears—more to them than meets the eye: why tears are a good source of biomarkers in Parkinson's disease. *Biomarkers in Medicine*. 2020 Feb;14(2):151-63. PMID: 32064896
- Dhandhukia JP, Li Z, Peddi S, **Kakan S**, Mehta A, Tyrpak D, Despanie J, MacKay JA. Berunda polypeptides: multi-headed fusion proteins promote subcutaneous administration of rapamycin to breast cancer in vivo. *Theranostics*. 2017;7(16):3856. PMID: 29109782
- Devi PB, Sridevi JP, **Kakan SS**, Saxena S, Jeankumar VU, Soni V, Anantaraju HS, Yogeeswari P, Sriram D. Discovery of novel lysine  $\epsilon$ -aminotransferase inhibitors: An intriguing potential target for latent tuberculosis. *Tuberculosis*. 2015 Dec 1;95(6):786-94. PMID: 26299907
- Bobesh KA, Renuka J, Jeankumar VU, **Shruti SK**, Sridevi JP, Yogeeswari P, Sriram D. Extending the N-linked aminopiperidine class to the mycobacterial gyrase domain: pharmacophore mapping from known antibacterial leads. *European Journal of Medicinal Chemistry*. 2014 Oct 6;85:593-604. PMID: 25127151
- Jeankumar VU, Renuka J, Kotagiri S, Saxena S, **Kakan SS**, Sridevi JP, Yellanki S, Kulkarni P, Yogeeswari P, Sriram D. Gyrase ATPase Domain as an Antitubercular Drug Discovery Platform: Structure-Based Design and Lead Optimization of Nitro thiazolyl Carboxamide Analogues. *ChemMedChem*. 2014 Aug;9(8):1850-9. PMID: 24962352
- Samala G, **Kakan SS**, Nallangi R, Devi PB, Sridevi JP, Saxena S, Yogeeswari P, Sriram D. Investigating structure–activity relationship and mechanism of action of antitubercular 1-(4-chlorophenyl)-4-(4-hydroxy-3-methoxy-5-nitrobenzylidene) pyrazolidine-3, 5-dione [CD59]. *International Journal of Mycobacteriology*. 2014 Jun 1;3(2):117-26. PMID: 26786333
- Kumar AS, **Kakan SS**, Rajesh N. A novel amine impregnated graphene oxide adsorbent for the removal of hexavalent chromium. *Chemical Engineering Journal*. 2013 Aug 15;230:328-37. doi.org/10.1016/j.cej.2013.06.089
- Kumar AS, Gupta T, **Kakan SS**, Kalidhasan S, Rajesh V, Rajesh N. Effective adsorption of hexavalent chromium through a three center (3c) co-operative interaction with an ionic liquid and biopolymer. *Journal of Hazardous Materials*. 2012 Nov 15;239:213-24. PMID: 23009794

#### Manuscripts in Preparation

- Kakan SS, Carr D A. “Parallels Between Ocular Biomarkers of Diabetic Retinopathy in STZ Induced Rodent Models and Human Subjects - A Systematic Review of Retinal Biomarkers”.
- Kakan SS, Li X, Edman MC, Hamm-Alvarez, SF. Tear and LG miRNA from the RAB3DKO mouse model.

#### Peer-Reviewed Proceeding Publications

##### Conference Oral/Invited Talk

- Lew M, Omidsalar A, Kakan SS, Gerke D, Tanveer M, Feigenbaum D, Tamadonfar E, Hamm-Alvarez SF, Hjelm BE. Tear Fluid as a Biomarker for Parkinson's Disease: Downregulation of DNA Repair Genes/Pathways via RNA-Seq Analysis. In *Neurology S37.007* April 2023. (Presented at American Association of Neurology – Annual Meeting 2023, Boston, MA)

##### Conference Posters

- **Kakan SS**, Ju Y, Edman M, Hamm-Alvarez SF. Serum and Tear Autoantibodies from nor Mice as Potential Diagnostic Indicators of Local and Systemic Inflammation in Sjogren's Syndrome. In *Arthritis & Rheumatology 2022* Sep 1 (Vol. 74, pp. 3992-3994). PMID: 36319591 (Presented at American College of Rheumatology - Convergence 2022, Philadelphia, PA)
- **Kakan SS**, Edman MC, Okamoto C, Hjelm BE, Hamm-Alvarez, SF; Identification of miRNAs in tears of a murine model of Sjögren's syndrome that may represent putative diagnostic biomarkers. In *Investigative Ophthalmology and Visual Science 2021*;62(8):3473. (Presented at Association for Research in Vision & Ophthalmology – Annual Meeting 2021, Virtual)
- **Kakan SS**, JeanKumar VU, Devi PB, Shalini S, Sriram D, Yogeeswari P. Targeting Mycobacterium tuberculosis' Lysine- $\epsilon$ -aminotransferase: Design, synthesis and *in vitro* evaluation of small molecule compounds. (Presented at the International Conference on "Drugs for the Future: Infectious Diseases" 2014, NIPER, Hyderabad, India).

#### Software

- **Kakan SS.** (2023). singhkakan/miRGrep: sRNAseq alignment using miRGrep (02/25/2020) (v1.0.0). Zenodo. <https://doi.org/10.5281/zenodo.7730419>

### Dissertation & Thesis

- **Singh Kakan, S.** (2022). Exploring Serum & Tear microRNAs as Biomarkers for Early Diagnosis of Sjögren's Syndrome. Available from Dissertations & Theses @ University of Southern California
- **Singh Kakan, S.** (2017). Comparing drug release kinetics of rapamycin bound FKBP-ELP fusion proteins (Order No. 10801952). Available from Dissertations & Theses @ University of Southern California; ProQuest Dissertations & Theses Global; ProQuest One Academic. (2114977667).

### Skills

**Computational Tools:** R Shiny, STAR Aligner, Bowtie, BWA, RSEM, Cell Ranger, SAMtools, BEDtools, GATK, Machine Learning Algorithms (Principal Component Analysis, Hierarchical Clustering, Linear Regression, Logistic Regression), R Studio, Visual Studio Code, Jupyter Hub, GitHub, High Performance Computing (SLURM, PBS), Docker, Google Cloud Platform, Jira, Confluence

**Languages & Databases:** Python (Numpy, Pandas, Scikit-learn, Matplotlib), Shell (Linux), R (Bioconductor, EdgeR, Seurat, DESeq2, ggplot2, plotly), C, SQL, TCGA, GenBank, NCBI, UniProt, PDB, SRA, Ensembl, ENA, GenCode, EMBL, IGV, GEO, Reactome, DAVID, TrinetX, IPA

**Molecular Biology Techniques:** Single Cell Suspension, RT-qPCR, In-vivo murine models, Microscopy (IHC, IF), Immuno Assays (WB/ELISA), RNA/DNA isolation, Cell Culture, Cytometry, Particle Size Analysis, Chromatography, Protein Synthesis, Dynamic Light Scattering (DLS), SPR, HPLC, UV-Vis, TEM, Extracellular Vesicle Isolation

**Domain:** Genomics, Bioinformatics, Biochemistry, Immunology, Pharmacology, Ophthalmology

### Honors & Awards

- **Rheum With a (re)View Mentee** 2023-2024  
American College of Rheumatology Journal Mentoring Program, Class of 2023
- **Original Research Featured** on the cover of *Investigative Ophthalmology & Visual Science* (IOVS), April 2023  
Peer-reviewed, international journal of the American Association for Research in Vision & Ophthalmology (ARVO)
- **Travel Grant** for ACR-Convergence, 2022, Philadelphia Nov 2022  
USC Mann School of Pharmacy
- **The Charles and Charlotte Krown Fellowship**, Finalist June 2021  
USC Mann School of Pharmacy
- **Travel Grant** for ARVO-Annual Meeting, 2021 May 2021  
USC Mann School of Pharmacy
- **Outstanding Teaching Assistant** May 2018  
USC Mann School of Pharmacy, for PHRD:559 Pharmacokinetics
- **J N Tata Scholar**  
The J N Tata Endowment, India, Mumbai
  - Loan scholarship of INR 6,00,000 (USD 9000) for MS at USC July 2015
  - Travel grant of INR 48,000 (USD 800) for MS at USC Aug 2015
  - Gift scholarship of INR 10,00,000 (USD 15,000) for MS at USC July 2016
- **Best Poster Award** Mar 2014  
International Conference on "Drugs for the Future: Infectious Diseases, Antimicrobial Drug Discovery: Challenges and Perspectives", NIPER, Hyderabad, India.

### Services & Outreach

#### Invited Peer-Review, International Journals and Conferences

2022: Frontiers in Surgery (1); Frontiers in Pharmacology (1)

2023: BioMed Research International (1); International Journal of Molecular Sciences (7);  
Frontiers in Pharmacology (1); Cancers (1); Cells (1); PeerJ (3); Genomics (4)  
Conference: American Association of Pharmaceutical Sciences (AAPS) - PharmSci 360  
2024: Frontiers in Immunology (2); OncoImmunology (1)  
Conference: American Association of Pharmaceutical Sciences (AAPS) - PharmSci 360

#### **Invited Talk/Seminar**

“Exploring Serum & Tear MicroRNAs as Biomarkers for Early Diagnosis of Sjögren’s Syndrome”, March 7<sup>th</sup>, 2023.  
University of Southern California, Department of Translational Genomics (DTG), Meeting Presentation.

#### **Judge, BioRender Illustration Spring Competition**

2022: Keck School of Medicine, University of Southern California

---

### **Teaching Experience**

#### **Graduate Teaching Assistant, Mann School of Pharmacy, University of Southern California**

Course: PHRD559 Pharmacokinetics, 2017, 2018

Responsibilities: Develop assignments questions, grade assignments, hold office hours for a Pharm.D. level course

Course: PHRD 623 Case Conference, 2018

Responsibilities: Grader and Procter

Course: PHRD 650 Advance Pharmacy Practice Experiences, 2018, 2019

Responsibilities: Administered the Objective Structured Clinical Examination (OSCE)

Course: PHRD 552 Pharmaceutics III, 2019

Responsibilities: Prepare class instruction material using PyMol and Chimera

---

### **Licenses & Certifications**

- **Python Data Structures** – Coursera (AFDUC79CKTVM)
- **Programming for Everybody (Getting Started with Python)** – Coursera (7DTWGQP2P5U5)
- **R Programming A-Z™: R For Data Science** – Udemy (UC-N069XL5H)

---

### **References**

#### D. Andrew Carr

Associate Director of Data Science, MantraBio Inc, South San Francisco

703-772-1764; Email: [dacarr2@gmail.com](mailto:dacarr2@gmail.com)

<https://www.linkedin.com/in/d-andrew-carr-phd/>

#### Sarah F. Hamm-Alvarez

Professor of Ophthalmology; Pharmacology & Pharmaceutical Sciences, USC

323-442-1445 (Office); Email: [shalvar@usc.edu](mailto:shalvar@usc.edu) [sarah.hamm-alvarez@med.usc.edu](mailto:sarah.hamm-alvarez@med.usc.edu)

#### David Wesley Craig

Professor of Translational Genomics & Co-Director, Institute of Translational Genomics, USC

323.442.7784 (Office); Email: [davidwcr@usc.edu](mailto:davidwcr@usc.edu) [davidwesley.craig@med.usc.edu](mailto:davidwesley.craig@med.usc.edu)

<https://www.linkedin.com/in/david-w-craig/>

#### J Andrew Mackay

Associate Professor of Pharmacology & Pharmaceutical Sciences; Biomedical Engineering; Ophthalmology, USC

323-442-4118 (Office); Email: [jamackay@usc.edu](mailto:jamackay@usc.edu)

<https://www.linkedin.com/in/jamackay/>