

MOHAMMED MUZAMIL KHAN

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Education

Boston University, Boston, MA

Ph.D., Bioinformatics (GPA: 3.74/4.0)

Advisor: Dr. Stefano Monti

Expected Availability: June '24

M.S., Bioinformatics

2019

Bioinformatics Graduate Scholarship (\$10K); India Overseas Scholarship (\$25K)

CMR Institute of Technology, Bangalore, India

2014

B.E., Computer Science and Engineering

Government of Karnataka Minorities Scholarship (\$5K)

Career Summary

Graduate Student Researcher,

**Monti Lab - Section of Computational Biomedicine (CBM),
Boston University School of Medicine (BUSM)**

2020-Present

Thesis title: *From Lesions to Treatment: A Multi-Species Multi-Transcriptomics Study of Oral (Pre-)Cancer Conditions*

Advisor: Dr. Stefano Monti

Project 1: Characterization and integration of transcriptional and microbial profiles of oral lesions and cancer

- Developed a bulk RNA-sequencing analysis pipeline in R incorporating multi-species and multi-transcriptomics data to investigate molecular signatures and pathway activity of oral (pre-) cancerous lesions.
- Employed machine learning techniques; supervised learning (random forest classifier) to impute missing smoking status information of patients, and unsupervised learning (clustering) methods to group oral pre-malignant lesions based on their transcriptomic profiles predictive of lesion severity.
- Integrated signatures and publicly available datasets (TCGA among others) from relevant studies to investigate disease progression.
- Built a cross-talk model that links human transcripts to microbial genera to study host-microbe interactions.
- First-author paper published in Human Genomics - Total RNA sequencing reveals gene expression and microbial alterations shared by oral pre-malignant lesions and cancer

Project 2: Investigation of cellular heterogeneity and plasticity from carcinogen-induced tumors in mice to study the inhibitory effects of the β -cat/CBP complex via small molecule inhibitor (in collaboration with a pharmaceutical company; name of company and drug confidential)

- Developed a single-cell analysis pipeline in R using an in-house high-performance computing cluster to accommodate ~65K cells from mouse tongue representative of various untreated and treated conditions that perform clustering, cell-type annotations, and composition analysis.
- Integrated signatures and publicly available from relevant datasets to create a comprehensive cell-type map indicative of disease progression.
- Identified unique immune and epithelial oncogenic profiles that attenuate on β -cat/CBP inhibition.

Other Projects:

- Identifying immune changes of immunosuppressive gene knockout in murine lung tumors
- Investigation of cellular heterogeneity from 4MOSC1 xenograft murine oral models
- Whole exome sequencing of pre-clinical models of patient-derived organoids of oral cancers

Rotation Student, Dries lab, Hematology and Oncology Division, BUSM

2021-2022

- Published a paper on spatial analysis along with other graduate students in Genome Research
- Cell-Cell Communication (CCC) using Ligand-Receptor interactions in a Spatial Context: investigating the interaction of various types of cells using ligand-receptor binding with spatial-omics and an unsupervised machine learning framework (halted due to graduate work).

Johnson Lab - CBM, BUSM, and Software Applications and Innovation Lab (SAIL).

2018-

2019

Scientific Programmer for "Interactive Single Cell RNA-Seq toolkit (sctk) using R/Shiny"

- Designed and implemented features on an easy-to-use single-cell GUI-based application, such as adding various differential expression analysis methods available with custom options, enrichR to perform geneset enrichment analysis, visualizing top significant genes individually to name a few.
- Benchmarked the software toolkit according to software standards and maintain code quality with version control (GitHub) for Bioconductor releases.
- A co-first author manuscript "Interactive single cell RNA-Seq analysis with the Single Cell Toolkit (SCTK)" is in final edits

Accenture Solutions Pvt. Ltd., Bangalore, India

2014-2017

Software Engineering Analyst with a focus on rapid automation, continuous integration, and delivery (CI/CD).

- Developed an automated test suite using Selenium and Jenkins to perform sanity checks in a remote environment(s) using Agile methodology which increased throughput and performance by about 33% resulting in a reduction of full-time employees (FTE) to nearly half.
- Designed and implemented training sessions for six incoming junior analysts that outlines best practices in their day-to-day activities and programming in Java to automate manual tasks via Selenium test-automation toolkit.
- Managed package deployments to all environments/servers up to production using IBM's Urban Code Deploy (UCD).

Skills

Technical: Statistical data analysis, Computational Biology, Bioinformatics Tool Development, Machine Learning, Data Science, Next Generation Sequencing (NGS), R Package Development, Web development, Data Visualization, Command Line Interfaces (CLI), Agile methodology, Software Engineering, Software Testing and Automation, Continuous Integration and Delivery (CI/CD)

Non-Technical: Critical Thinking, Problem-Solving, Public Speaking, Outreach

Programming languages: R, R/Shiny, Python, C, C++, C#, CSS, Java, HTML, scripting (Perl, PHP), Selenium, SQL

Publications

Published Papers

1. **Khan, M.M.**, Frustino, J., Villa, A., Nguyen, B. C., Woo, S. B., Johnson, W.E., Varelas, X., Kukuruzinska, M., Monti, S., *Total RNA sequencing reveals gene expression and microbial alterations shared by oral pre-malignant lesions and cancer. Human Genomics*, 2023. doi.org/10.1186/s40246-023-00519-y

- Atherton, K., Han, X., Chung, J., Cherry, J., Baucom, Z., Saltiel, N., Nair, E., Abdolmohammadi, B., Uretsky, M., **Khan, MM.**, et al. *Association of APOE Genotypes and Chronic Traumatic Encephalopathy*. *JAMA Neurol.*, 2022. doi:10.1001/jamaneurol.2022.1634
- Dries, R., Chen, J., Rossi, N., **Khan, MM.**, Sistig, A., Yuan, GC., (2021) *Advances in spatial transcriptomic data analysis*, *Genome Research*. 2021. doi: 10.1101/gr.275224.121 (100+ citations)

Manuscripts in preparation

- scRNAseq analysis of murine oral tumors upon β -catenin/CBP inhibition reveals a distinct reduction in onco-phenotypes*
Khan, M.M., Reed, E., Kroehling, L., Bais, M., Varelas, X., Kukuruzinska, M., Monti, S.,
- Interactive single cell RNA-Seq analysis with the Single Cell Toolkit (SCTK)*
Jenkins, D.*, **Khan, MM.***, Faits, T., Zhang, Y., McFarlane, A., Zhao, Y., Dries, R., Yajima, M., Campbell, J., Johnson, WE. (*co-first authors)
- IFN gamma-induced Immunosuppression in Lung Carcinoma is Mediated by an Environmental Chemical Receptor (AhR) through PD-L1 and IDO Control*
Snyder, M., Wang, Z., Lara, B., Fimbres, J., **Khan, MM.**, Monti, S., Sherr, D. [under review; Cell Reports]

Peer-reviews

- Transcriptogram method indicates Ribosome in Tongue Cancer and Immune Response Pathways in Larynx Cancer as possible therapy targets*
Thomas et al., *Frontiers in Big Data*, section Medicine and Public Health, February 2022
- SCREP: an R package for GO and REACTOME Enrichment Plots using scRNA-Seq Data*
Farjood et al., *Bioinformatics Advances*, October 2022

Conference Posters & Presentations

Oral Presentations

- International Conference on Systems Biology (ICSB)**, Hartford, CT, USA, October 2023 *Inhibition of β -catenin/CBP Activity in Murine Oral Tumors Attenuates Stress Response*
[Online link: <https://icsb2023.bioscience-ct.net/Program/abstract/SC.05/index.html>]
- Intelligent Systems for Molecular Biology (ISMB) Conference**, Madison, WI, USA, July 2022
Characterization and integration of transcriptional and microbial profiles of oral lesions and cancer
- International Association for Dental Research (IADR)/American Association for Dental Research (AADR)**, July 2021, Virtual
Characterizing Transcriptomic Profiles and Microbial Abundance of Oral Potentially Malignant Disorders
- BU Bioinformatics Student-organized Symposium (SoS)**, June 2021, *Host and microbial cross-talk in Oral Pre-cancerous Lesions*

Poster Presentations

(* indicates presenting-author)

1. **American Association for Cancer Research (AACR)** AHNS Head and Neck Cancer Conference, Montreal, Canada, July 2023
*Targeting Murine Oral Tumors by Pharmacological Inhibition of β -catenin/CBP Epigenetic Activity**
2. **Intelligent Systems for Molecular Biology (ISMB)** Conference, Madison, WI, USA, July 2022
*Characterization and integration of transcriptional and microbial profiles of oral lesions and cancer**
3. *Application of module detection methods to TCGA Head and Neck Cancer dataset*
4. **International Association for Dental Research (IADR)/American Association for Dental Research (AADR)**, July 2021, Virtual
*Characterizing Transcriptomic Profiles and Microbial Abundance of Oral Potentially Malignant Disorders**
5. **Intelligent Systems for Molecular Biology (ISMB)** Conference, July 2020, Virtual
*Pleiotropy analysis of chronic traumatic encephalopathy with other tauopathies including progressive supranuclear palsy and Alzheimer's disease**
6. *APOE ϵ 4 is associated with chronic traumatic encephalopathy (CTE)*
7. *Genome-wide association study of chronic traumatic encephalopathy*
8. *The H1b MAPT Sub-Haplotype provides a protective effect against CTE progression*
9. **Alzheimer's Association International Conference (AAIC)**, July 2020, Virtual
Genome-wide association study of chronic traumatic encephalopathy

University-wide Evans' Research Days Symposium, Boston University School of Medicine

1. *Characterization of Intra-Tumor Heterogeneity in Murine Oral Tumor Models of β -catenin/CBP Inhibition, 2023**
2. *Investigation of Cellular Heterogeneity in 4NQO-induced Tumors in Mice and Inhibition through Therapeutic Interventions, 2022**
3. *Characterizing Transcriptomic Profiles and Microbial Abundance of Oral Pre-Cancerous Lesions, 2021**
4. *Pleiotropy analysis of chronic traumatic encephalopathy with other tauopathies including progressive supranuclear palsy and Alzheimer's disease, 2020**
5. *Interactive single cell RNA-Seq analysis with Single Cell Toolkit (SCTK), 2018**

Awards

Government of Karnataka India Overseas Scholarship	2017-2019
o for Indian students studying abroad with proven academic excellence	
Bioinformatics Graduate Program, Boston University	2017-2019
o MS scholarship for incoming students with proven academic merit	
Accenture Client Excellence Award	2016
o for achieving goals set for FY2016 and automating almost 80% of tasks	

Accenture DevOps Trailblazer Award	2015
○ completion of Selenium software test suite automation	
Accenture High Performer Award	2015
○ Best new joiner	
Government of Karnataka Minorities Scholarship	2011-2014
○ for academic excellence	
Best dissertation project for 3D Campus Tour [Case: CMRIT college campus]	2014
○ for the project on the college campus virtual tour simulation	
CMR Jnanadhara Trust Scholarship	2012
○ merit-based scholarship for undergraduates	

Volunteering and Leadership Service

Bioinformatics Grad Student Recruitment, ABRCMS Conference	2023
Member of Organizing Committee	
○ Section of Computational Biomedicine DEIA Initiatives	2023-present
○ Bioinformatics-Organized Students (BiOS) Support Team	2021-present
○ Section of Computational Biomedicine Retreat	2022-2023
○ BU Bioinformatics Student-organized Symposium (SoS)	2022
Grad Mentor for Qualifying Exam Prep	2023
Co-mentor for Challenge Project	2021-2022
Graduate Student Mentor	2018-present
R Programming for High-School Students Mentor	2020-2021

Teaching experience

Teaching Assistant	
○ BS831: Genomics Data Mining, Boston University	2022-2023
○ 10CS72: Embedded Computing Systems, CMR Institute of Technology	2013
○ 10CS842: Software Testing, CMR Institute of Technology	2014
○ Machine Learning workshop in R for BRITE-REU	2022
Tutor	
○ Engineering Mathematics (1-4)	2010-2013
○ High School - Physics, Chemistry, Mathematics, and Biology	2010-2017

International Memberships in Professional Societies

American Association for Cancer Research (AACR)	2023-2024
Intelligent Systems for Molecular Biology (ISMB)	2020-2022
International Association for Dental Research (IADR)/	2021
American Association for Dental Research (AADR)	