

Muhammad Asif Ali

Curriculum Vitae

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EDUCATION

Fa25-Present	Doctor of Philosophy Crop Sciences: Bioinformatics Department of Crop Sciences University of Illinois Urbana-Champaign
Fa24-Sp25	Doctor of Philosophy (Position terminated due to budget cuts) Department of Biological Sciences (BISI) Computational Biology, Bioinformatics, and Genomics University of Maryland College Park
Fa22-Sp24	Master of Science (4.0/4.0) Bioinformatics Department of Crop Sciences University of Illinois Urbana-Champaign
Fa17-Sp21	Bachelor of Science (3.8/4.0) Bioinformatics Department of Biosciences COMSATS University

PUBLICATIONS

4. **Ali, M. A.** (2024). AlphaFold2 reveals structural patterns of seasonal haplotype diversification in SARS-CoV-2 structural protein variants [Thesis, University of Illinois at Urbana-Champaign]. <https://www.ideals.illinois.edu/items/131533>
3. **Ali, M. A., & Caetano-Anollés, G.** (2024). AlphaFold2 Reveals Structural Patterns of Seasonal Haplotype Diversification in SARS-CoV-2 Nucleocapsid Protein Variants. *Viruses*, 16(9), 1358. <https://doi.org/10.3390/v16091358>
2. **Ali, M. A., & Caetano-Anollés, G.** (2024). AlphaFold2 Reveals Structural Patterns of Seasonal Haplotype Diversification in SARS-CoV-2 Spike Protein Variants. *Biology*, 13(3), 134. <https://doi.org/10.3390/biology13030134>
1. Tomaszewski, T., **Ali, M. A.**, Caetano-Anollés, K., & Caetano-Anollés, G. (2023). Seasonal effects decouple SARS-CoV-2 haplotypes worldwide. *F1000Research*, 12, 267. <https://doi.org/10.12688/f1000research.131522.1>

**Date designations: Fa, Sp, and Su denote Fall, Spring, and Summer respectively*

RESEARCH EXPERIENCE

Fa25-Present *Graduate Research Assistant; University of Illinois Urbana Champaign, IL, USA*
Mentor: Dr. Gustavo Caetano-Anolles, Department of Crop Sciences
Subject: Protein evolution, finding signals of most ancient amino acids using molecular measurements.

Fa24-Sp25 *Research Rotations; University of Maryland College Park, MD, USA*

- *Simon Lab*
Title: Analyzing the importance of RNA loop content on the thermostability and binding capacity of viral RNA to RNA-dependent RNA polymerase (RdRp).
Description: Ran permutation analysis of various RNA sequences to determine if thermostability of RNA loops can impact RNA binding to transcription factors experimentally.
Mentor: Dr. Anne Simon, Department of Molecular and Cellular Biology
- *Pierce Lab*
Title: Assessing the capability of Inverse Folding (IF) at predicting binding affinities of antibody-antigen complexes against traditional docking methods.
Description: Benchmarked ESM-IF, ProteinMPNN, FoldX, and other tools to see if we can accurately predict binding capability between antibody-antigen complexes using their output scores.
Mentor: Dr. Brian Pierce, Institute for Bioscience and Biotechnology Research
- *Johnson Lab*
Title: Using AI to determine informative sites on Ancient human DNA fragments and to filter out modern contaminant DNA.
Description: Analyzed different ML techniques such as Random Forest and CNNs to filter out modern contaminant DNA from ancient DNA samples.
Mentor: Dr. Phillip Johnson, Department of Biology

Fa22-Sp24 *Graduate Research Assistant; University of Illinois Urbana Champaign, IL, USA*
Mentor: Dr. Gustavo Caetano-Anolles, Department of Crop Sciences
Subject: Analysis of haplotypic diversification of SARS-CoV-2 structural proteins using AlphaFold2.

- Collaborated with researchers across departments to conduct an in-depth analysis of the structural implications of SARS-CoV-2 mutations, targeting haplotypes previously unexplored in current research literature.
- Utilized AlphaFold2, Chimera, and US-align to conduct detailed analyses of 13 Haplotypes and 3 Variants of Concern of the SARS-CoV-2 Spike-protein, resulting in the identification of key structural changes that could impact virus infectivity and transmission rates.
- Conducted comprehensive analyses elucidating the intricate structural and functional ramifications among protein mutations, contributing to a deeper understanding of molecular dynamics and disease mechanisms.

Sp21 *Student Researcher, COMSATS University, Islamabad, Pakistan*
Mentor: Dr. Malik Nadeem Akhtar, Department of BioSciences

Thesis Title: Development of a Workflow for the Large Scale Processing of Cancer-Specific Tandem Mass Spectrometry Datasets.

- Developed a robust pipeline tailored for the analysis of tandem mass spectral data, surpassing standalone solutions by up to 30% in protein identification efficiency. Integrated permutation testing using a decoy database and False Discovery Rate (FDR) analysis to ensure statistical robustness and mitigate false positives.
- Concluded that integrating multipronged methodologies and heuristic techniques yields superior protein identification rates with heightened confidence levels.

Proficiencies:

Programming	Python, R, SAS, BASH (Limited: C++, Java, C#)
Libraries	Numpy, Pandas, Matplotlib, Sklearn, Scipy, Pytorch, BioPython
Software	AlphaFold, LocalColabFold, Chimera, PyMol, US-align, TM-align, Pajek, PAUP, IQ-Tree, Galaxy, OMSSA, MSGF+, Tide, X!Tandem, BindCraft, ProteinMPNN, ESM-IF, FoldX, ViennaRNA, Bio3D package, SAMtools
Databases	SQL, MySQL, GCP
General lab skills	PCR, Gel Electrophoresis, Microscopy, Bacterial plating, Spectrophotometry, greenhouse management

TEACHING EXPERIENCE

Fa25-Present *Teaching Assistant; University of Illinois Urbana Champaign, IL, USA*

Mentor: Dr. Jennifer Nelson

Course: HORT 105 (Vegetable Gardening Lab)

- Co-instructor for two lab sections (~30 students per lab), responsible for taking students to the greenhouse and helping them with their projects and grading assignments.

Fa24-Sp25 *Teaching Assistant; University of Maryland College Park, MD, USA*

Mentor: Dr. Swarna Mohan, Department of Cell Biology & Molecular Genetics

Course: BSCI171 (Cellular and Molecular Biology Lab)

- Primary instructor for two lab sections (24 students per lab) that taught students wet lab skills such as bacterial plating, microscopy, spectrophotometry, and PCR.
- Organized multi-week research experiments to help students understand the scientific process and how to write a research paper and present their findings.
- Received excellent student ratings for both semesters taught, ranging from 4.6 to 4.8 out of 5.

Sp24 *Teaching Assistant; University of Illinois Urbana Champaign, IL, USA*

Mentor: Dr. Martin Bohn, Department of Crop Sciences

Course: CPSC116 (The Global Food Production Web)

- Facilitated semester long group projects and held office hours for students (Class size: 150).
- Provided bi-weekly summaries of student answers to discussion posts as a presentation before lectures relating their queries and course content to real world applications.

- Lead lecture independently for one session.
- Graded weekly assignments and project progress reports.

Sp23-Sp24 *Teaching Assistant; University of Illinois Urbana Champaign, IL, USA*

Mentor: Dr. Jennifer Nelson

Course: HORT 105 (Vegetable Gardening Lab)

- Co-instructor for 1 lab section (~30 students) where I held interactive lab activities and facilitated group discussions, resulting in an increase in student engagement and participation.
- Managed grading of student assignments with detailed feedback, maintaining a high average student satisfaction rating of 4.6 out of 5.
- Assessed and addressed students' learning needs during one-on-one consultations, leading to a 10% improvement in overall exam scores.

Sp23 *Teaching Assistant; University of Illinois Urbana Champaign, IL, USA*

Mentor: Dr. Kris Lambert, Department of Crop Sciences

Course: PLPA 200 (Plants, Pathogens, and People)

- Graded weekly assignments and held office hours (25 students).
- Maintained a student satisfaction rate of 4.5/5.

ACADEMIC SERVICE

Su25 Peer reviewed for 1 article in *The Protein Journal*, **Springer Nature**

(<https://link.springer.com/journal/10930>)

Fa25 Peer reviewed for 1 article in *Evolutionary Bioinformatics*, **Frontiers in**

Bioinformatics

(<https://www.frontiersin.org/journals/bioinformatics/sections/evolutionary-bioinformatics>)

AWARDS, HONORS, AND SCHOLARSHIPS

Sp25 **Student Group of the Year Award.** Awarded to the student organization 'Queer Muslim' founded by me in service of the LGBTQ Muslim community at University of Maryland College Park, USA.

Sp25 **Deans Fellowship.** Financial supplement awarded to students based on academic merit to boost program retention rates. University of Maryland College Park, USA. Award: \$2,500

Fa24 **Deans Fellowship.** Competitive award intended for new PhD students that show academic merit based on past accomplishments. University of Maryland College Park, USA. Award: \$10,000.

Sp24 **Excellent TA for HORT105 and CPSC116.** Center for Innovation in Teaching & Learning (CITL) Graduate Academy: University of Illinois Urbana-Champaign. USA.

Sp24 **Jonathan Baldwin Turner Fellowship.** Award: three-year fellowship support of \$30,000/year for the Food Science and Human Nutrition PhD program at the University of Illinois Urbana-Champaign (Not pursued).

- Sp21 **Institute Gold Medal.** Awarded for ranking highest across all 6 Campuses of COMSATS University for the BS Bioinformatics program. COMSATS University, Islamabad, Pakistan.
- Sp21 **Campus Gold Medal.** Awarded for ranking highest for the BS Bioinformatics program. COMSATS University, Islamabad, Pakistan.
- Fa18 **PM's National Laptop Scheme.** A laptop was awarded in a nationwide merit competition for academic excellence. Higher Education Commission, Pakistan.

SERVICE AND OUTREACH

- Su23 *Volunteer Instructor*
CITL Grad Academy University of Illinois Urbana-Champaign
- Led instructional sessions at The Graduate Academy for College Teaching, imparting expertise in classroom instruction to empower new TAs with essential strategies and valuable experience, fostering a culture of effective and inclusive teaching practices.
 - Guided Microteaching sessions, mentoring new TAs in refining their teaching abilities and offering constructive feedback, while personally gaining valuable insights and knowledge in the process.
- Fa23 *Volunteer*
Etc Coffeehouse, Wesley Church, Urbana, Illinois, USA
- Helped out with managing the student café on Wednesday nights.
- Sp19 *Foster Fellow*
Foster Learning Pakistan (FLP), Islamabad, Pakistan
- Organized workshops in underdeveloped schools regarding future careers and opportunities
 - Lead charity drives to collect donations for schools in underprivileged areas
 - Organized a tree plantation drive
- Fa17 *Survey Team Head*
Chadar Society, COMSATS University Islamabad, Pakistan
- Led a team to conduct surveys in the slums inhabited predominantly by religious minorities
 - Participated in multiple charity drives to distribute clothes and food in slum areas for Christmas

LEADERSHIP

- Fa25 *Graduate Student Representative*
Inclusion, Diversity, Equity and Access Committee, Department of Crop Sciences, University of Illinois Urbana-Champaign
- Provided input on student barriers relating to accessibility issues on campus to improve the student experience and ensure proper accommodations can be provided in the future.

- Fa24-Sp25 *President*
Queer Muslim, University of Maryland College Park
- Founded QM to provide LGBTQIA+ Muslim students a safe space to build community.
 - Host semi-weekly gatherings to help students find others like them and build friendships.
 - Organized a Ramadan dinner for QM members with the help of donors.
- Sp24 *Graduate Student Representative*
Inclusion, Diversity, Equity and Access
Committee, Department of Crop Sciences, University of Illinois Urbana-Champaign
- Provided strategic guidance and consultation to IDEA committee faculty members on matters pertaining to departmental inclusivity, fostering a more diverse and equitable academic environment.
 - Partnered with fellow student representatives to spearhead initiatives aimed at enhancing student engagement and understanding student needs, facilitating a more responsive and student-centric campus community.
- Sp23 *President*
Queer Muslim, University of Illinois Urbana-Champaign
- Established QM catering to LGBTQIA+ Muslims at UIUC, fostering inclusivity and community support unprecedented in university history.
 - Organized Ramadan events promoting interfaith harmony among students of diverse faiths and sexual orientations, fostering understanding and unity within the community.
 - Partnered with other student organizations and cultural centers to co-host inclusive events, fostering cross-cultural dialogue and collaboration within the university community.

EMPLOYMENT AND EXTRACURRICULARS

- Sp23 *Speaking Queerly Panelist*
Gender and sexuality Resource Center, University of Illinois Urbana Champaign
- Co-lead a panel discussion on issues facing the LGBTQIA+ community with respect to interpersonal relationships and navigating life as a queer person at the UIUC
- Fa21 *Jr. Software Developer*
Z-Axiss, Islamabad, Pakistan
- Managed a complex legacy code base, seamlessly integrating new features to meet evolving client needs while ensuring system stability and performance.
 - Engineered robust Django APIs to enable efficient and accurate data retrieval, enhancing system performance and user experience.
 - Partnered with the Quality Assurance team to identify and address software defects promptly, fostering a collaborative environment focused on continuous improvement.

- Spearheaded the standardization of bug reporting procedures office-wide, optimizing workflow efficiency and significantly reducing error rates through enhanced communication and accountability.

Sp18 *Lead Performer*

China Study Centre, COMSATS University

- Led a performance team for the arrival of the Chinese Ambassador to Pakistan
- Arranged rehearsals throughout the first half of the semester to train other team members