

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 & POSTERS

5. **Ali, M. A.** (2025, December 10th). AI Guided Mutation Prediction and Vaccine Development Using Inverse Folding [Poster presentation]. Crop Sciences Student Poster Symposium, Urbana, IL, United States. <https://hdl.handle.net/2142/130489> (Pending approval)
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>

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 **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.

LEADERSHIP

- Fa25-Present *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.
- Sp24 *Event Co-Organizer & Graduate Student Panelist*
Graduate School Applications Workshop
Co-organizers: Harrison Hall and Arista Sophia.
- Organized a Q&A panel session where undergraduate students can ask graduate students from various backgrounds (MS, PhD, direct PhD, MS to PhD and international grad students) questions about how they applied for grad school and what the process was like.
 - Covered topics include: Application deadlines, professor outreach, email etiquette, writing a statement of purpose, preparing a resume/CV, selecting schools and location etc.
 - Procured funding for the event from the IDEA committee at Crop Sciences.
- 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.

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

EMPLOYMENT AND EXTRACURRICULARS

- Fa21 *Jr. Software Developer*
Z-Axis, 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