

Muhammad Bilal

Oakland University, Michigan, USA
mbilal@oakland.edu , +1 (947) 273-9369

Doctoral Researcher in Microbial Evolution and Comparative Genomics

My research investigates microbial genome evolution across deep time through comparative genomics, pangenome reconstruction, and molecular-clock phylogenomics. I develop time-resolved models that reveal how genomic innovation shaped prokaryotic diversification and underpin principles for identifying potential biosignatures beyond Earth.

CURRENT POSITION

PhD Scholar (2024 – Present)

Department of Biological and Biomedical Sciences, Oakland University

Research Assistant | [Dr. Fabia Ursula Battistuzzi](#)

- Investigating microbial pangenomes, phylogenetics, and evolutionary genomics to elucidate patterns of genome diversity, adaptation, and lineage evolution.
- Designing and implementing computational workflows for large-scale comparative and pangenome analyses.
- Characterizing core and accessory genome evolution across microbial populations using integrative bioinformatics and phylogenomic approaches.

Teaching Assistant | Genetics Laboratory (BIO 3401), Dr. Doug Wendell

- Supervising DNA/RNA extraction, PCR, gel electrophoresis, and genetic analysis experiments.
- Guiding students in hypothesis development, bioinformatics (BLAST, genome browsers), and data interpretation.
- Assessing student performance through grading, lab report evaluation, and mentoring.

EDUCATION

2021—2023	MPhil Biotechnology (CGPA: 3.68/4.0) University of Sargodha, Sargodha, Pakistan, https://su.edu.pk/
2017—2021	BS Biotechnology (CGPA: 3.04/4.0) University of Sargodha, Sargodha, Pakistan, https://su.edu.pk/

RESEARCH & PROFESSIONAL EXPERIENCE

Teaching Assistant, Department of Biological Sciences, Oakland University

BIO 1201 – Biology Laboratory (Fall 2024, Fall 2025)

- Conducted laboratory sessions on Mendelian genetics, phylogenetic analysis, and evolutionary biology, emphasizing hands-on experimentation and critical analysis.
- Provided comprehensive training in scientific writing, experimental design, and statistical analysis, fostering analytical and research skills among students.
- Evaluated lab reports with a focus on methodological accuracy, data interpretation, and adherence to scientific standards and laboratory protocols.

Program Coordinator, Data Analytics in Multi-Omics Science ([DAMOS](#)) NRT Program, 2025, Oakland University

- Coordinated NSF-funded graduate training integrating omics, data analytics, and entrepreneurship.
- Organized workshops and modules on R, Python, and multi-omics data analysis.
- Facilitated cross-departmental collaboration to promote data-driven research.

MPhil Research (2021 – 2023)

- Conducted **comparative genomics and pangenome analysis** of *Bacteroides thetaiotaomicron*, *Yersinia enterocolitica*
- Explored **functional diversity, gene regulation, and metabolic capabilities** for probiotic applications.
- Investigated **host-microbe interactions** using computational and bioinformatics approaches.

RESEARCH INTERESTS

- Microbial Pangenomics & Evolutionary Dynamics
- Comparative Genomics & Functional Adaptation in Bacteria
- AI-driven modeling of genome evolution and biosignature detection
- Astrobiology & Microbial Evolution in Extraterrestrial Environments

- Pangenome-Based Phylogenetics & Tree of Life Reconstruction
- Host-Microbe Interactions & Microbiome Functional Genomics
- Genomic Resilience & Survival Strategies in Extreme Microbial Ecosystems
- Space Biology & Genetic Adaptations in Extreme Conditions
- Molecular clock calibration and divergence-time estimation
- Horizontal Gene Transfer & its Role in Evolutionary Innovation

SKILLS AND EXPERTISE

Domain	Key Tools & Competencies
<i>Pangenomics & Comparative Genomics</i>	Roary, Panaroo, CoreCruncher, PPanGGOLiN, OrthoFinder, PanX, Anvi'o
<i>Phylogenetic Inference & Modeling</i>	IQ-TREE, MEGA, RAxML-NG, FastTree, MAFFT, MUSCLE5, ASTRAL, ModelFinder
<i>Molecular Clocks & Time Estimation</i>	BEAST2, MCMCTree, TreeTime, RelTime, r8s
<i>Functional Annotation & Pathway Analysis</i>	Prokka, EggNOG-mapper, KEGG, COG, InterProScan, Blast2GO
<i>Molecular Biology & Laboratory Techniques</i>	PCR, qPCR, DNA/RNA extraction, recombinant cloning, gel electrophoresis, ELISA, protein–protein interaction assays
<i>Programming & Data Analysis</i>	Python, R, Bash, Linux (HPC), Snakemake, Slurm, machine learning in genomics, AutoDock, MOE
<i>Visualization & Reporting</i>	ggtree, figtree, Seaborn, Matplotlib, iTOL, ggplot2, BioRender, Adobe Illustrator, MS Office Suite
<i>Scientific Writing & Communication</i>	Research article preparation, grant writing, conference presentations, data visualization, scientific reporting

PUBLICATIONS

Bilal, M., & Battistuzzi, F. U. (2026). Pangenomes: Unveiling Genetic Diversity Across Populations and Beyond. In J. B. Wolf & C. A. M. Russo (Eds.), *Encyclopedia of Evolutionary Biology* (2nd ed., Vol. 2, pp. 294–306). Elsevier Academic Press. <https://doi.org/10.1016/B978-0-443-15750-9.00139-7>

Kanwal, M., Basheer, A., Bilal, M., Faheem, M., Aziz, T., Alamri, A. S., ... & Jamal, S. B. (2024). In silico vaccine design for *Yersinia enterocolitica*: A comprehensive approach to enhanced immunogenicity, efficacy, and protection. *International Immunopharmacology*, 143, 113241. <https://doi.org/10.1016/j.intimp.2024.113241>

COURSES & ACHIEVEMENTS

Genomic & Bioinformatics Training: *Introduction to Genomic Technologies* (Johns Hopkins University), *Computational Genomics & Bioinformatics* (ICCBS, University of Karachi), *Bacterial Bioinformatics* (University of Virginia), *Genomics: Decoding the Universal Language of Life* (University of Illinois).

Biotechnology & Industrial Applications: *Applications of Biotechnology* (Alison), *Industrial Biotechnology* (University of Manchester), *Chromatography* (Alison).

Programming & Data Analysis: *Introduction to R* (Great Learning Academy), *Command Line in Linux*, *Bash Shell Scripting*, *Microsoft Excel* (Coursera).

Artificial Intelligence & Machine Learning: *Deep Learning, Python & Machine Learning* (Codanics).

Other Certifications: *Programme Guidance for Adolescents* (UNICEF), *Higher Aptitude Test (HAT-IV-PhD)* (HEC) passed with distinction.

Ongoing Courses: *Introduction to Genetics & Evolution* (Duke University), *Deep Learning, Python & Machine Learning* (Codanics), *Functional Genomics and Bioinformatics* , *Ethics and practice of science*

Professional Memberships: Vice president, Association of Graduate and Professional Students (AGPS), OU. Member, [Sigma Xi](#): The Scientific Research Honor Society; Member, Biology Graduate Student Organization (BGSO), Oakland University

RECOMMENDATIONS

Dr. Fabia U. Battistuzzi, Ph.D. | battistu@oakland.edu
 CAS Associate Dean & Professor, Department of Biological Sciences
 Affiliated Faculty, Department of Bioengineering
 Oakland University, Rochester, MI, USA