

AQIB REHMAN MAGRAY, Ph.D.

Assistant Professor (Innate Immunology & Host–Pathogen Interactions)

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PROFILE

Immunologist and molecular biologist studying macrophage defenses against fungal and mycobacterial pathogens using larval zebrafish genetics (CRISPR/Cas9), live confocal imaging, and quantitative infection assays. Trained across India, Germany, and the United States, with publications in Aquaculture, Microbial Pathogenesis, Molecular Immunology, and Fungal Biology Reviews. Building a zebrafish research program focused on phagosome maturation (v-ATPase, Rab5/Rab7, LAMP1/2), PI3K–NOX coupling, xenophagy, and host-directed therapies.

RESEARCH INTERESTS

- Innate immune signaling in macrophages (PI3K–NOX axis, v-ATPase-driven acidification)
- Phagosome maturation and antifungal/mycobacterial killing in vivo (zebrafish)
- Host-directed interventions for drug-resistant infections
- Aquaculture immunology and pathogen surveillance

EDUCATION

Ph.D., Zoology — University of Kashmir, India (2021)

M.Sc., Zoology — University of Kashmir, India (2014)

B.Sc., Biology — University of Kashmir, India (2011)

APPOINTMENTS & RESEARCH EXPERIENCE

Assistant Professor, Department of Zoology, University of Kashmir, India (2025–present)

Postdoctoral Research Fellow, Rosowski Lab, Clemson University, USA (2023–2025)

Assistant Professor, Central University of Kashmir, India (02/2022–12/2022)

Lecturer, Dept. of Higher Education, J&K, India (07/2021–12/2021)

Robert S. McNamara Fellow (World Bank), Leibniz Institute for Farm Animal Biology (FBN), Germany (2019–2020)

CSIR-UGC Junior/Senior Research Fellow, India (2017–2021)

SELECTED ACHIEVEMENTS, FELLOWSHIPS & AWARDS

- STEM Postdoctoral Teaching Fellowship, OTEI, Clemson University (2025)
- Robert S. McNamara Fellowship, World Bank (2019)
- CSIR-UGC NET-JRF, AIR-63 (Life Sciences) (2017); JRF (2018–2020), SRF (2020–2021)
- Best Presentation, 13th J&K Science Congress, University of Kashmir (2018)
- Travel: DST-SERB (India) and University of Kashmir travel grants—EAFP Conference, Porto (2019)

PROFESSIONAL MEMBERSHIPS

American Society for Cell Biology (2023–); EAFP (2019); Zoological Society of India (2018–2019);

American Fisheries Society (2018)

Teaching Experience

Undergraduate

2021. Developmental Biology, Cell Biology, and General Zoology. Lecturer. Government Degree College, Ganderbal, India

2022. Evolution and General Parasitology. Assistant Professor. Central University of Kashmir, India

- Delivered lectures on developmental biology, cell biology, and general zoology to undergraduate students, incorporating theoretical and practical components.

Graduate (Masters)

2024. Environmental Microbiology. Instructor. Senior Seminar, Clemson University, USA

- Taught Environmental Microbiology to senior seminar students, covering key concepts in microbiological processes affecting ecosystems and human health.

2022. Cell and Molecular Biology, Immunology, and Molecular Parasitology. Assistant Professor. Central University of Kashmir, India

- Taught Cell and Molecular Biology, Immunology, and Molecular Parasitology to undergraduate and postgraduate students. Also provided practical training in microscopy and molecular techniques.

Graduate (PhD)

2024. Readings in Evolution. Instructor. Graduate course, Department of Biological Sciences, Clemson University, USA

- Instructor for Readings in Evolution to graduate students, guiding literature review and discussions on evolutionary biology.

2024. Recent Advances in Microbiology Research. Instructor. Graduate course, Department of Biological Sciences, Clemson University, USA

- Course on research advances in microbiology focuses on the latest research developments and innovations in microbiology.

2022. Microscopy and Advanced Molecular Techniques. Assistant Professor. Department of Zoology, Central University of Kashmir, India

- Taught a graduate course on microscopy and advanced molecular techniques, providing both hands-on training and theoretical instruction on cutting-edge molecular biology research methods.

JOURNAL REVIEWING

Frontiers in Cellular and Infection Microbiology; BMC Microbiology; Infectious Disease Reports

PUBLICATIONS (SELECTED, PEER-REVIEWED)

2023–2018

- Hafeez S., Yaqoob S., Magray A.R., Kamili A.N., Ganai B.A. (2023) International Microbiology.
- Dar S.A. ... Magray A.R. ... (2023) Microbial Pathogenesis 187:106512.
- Magray A.R. ... Rebl A. (2022) Molecular Immunology 142:120–129.
- Magray A.R. ... (2021) Aquaculture 542:736876.
- Magray A.R. ... (2020) Microbial Pathogenesis:104715.
- Magray A.R. ... (2020) Aquaculture 518:734837.
- Magray A.R. ... (2019) Fungal Biology Reviews 33:166–179.
- Shabir U. ... Magray A.R. ... (2018) Microbial Pathogenesis 114:50–56.

(Additional earlier items, book chapter, and works in preparation available on My Bibliography:

<https://www.ncbi.nlm.nih.gov/myncbi/1n5ISX97smcUgo/bibliography/public/>)

MANUSCRIPTS IN PREPARATION / SUBMISSION

- Magray A.R., Rosowski E.E. Macrophage v-ATPase controls *A. fumigatus* germination and hyphal growth independent of spore killing (Cell Host & Microbe, in preparation, 2025).

CONFERENCE TALKS & PRESENTATIONS (SELECTED)

Oral, Cell Biology of Eukaryotic Pathogens (CBEP) — EPIC, Clemson (2023, 2024)

Oral, Cell Bio 2024 conference, San Diego (ASCB)

Oral, American society of Microbiology (ASM), Fall meeting, South Carolina Chapter 2024

Oral, 19th International Conference on Diseases of Fish and Shellfish (EAFP), Porto (2019)

Contributed talks — J&K Science Congress (2018), Animal Science Congress (2018); multiple national seminars

WORKSHOPS & TRAININGS (SELECTED)

- Digital Image Analysis with FIJI/ImageJ — EPIC & Clemson Light Imaging Facility (2024)
- Scientific Integrity & Research Ethics (1 credit) — Clemson (2023)
- Advanced Light Microscopy, Flow Cytometry & Image Analysis — Clemson (2023)
- RNA-seq Workshop — Clemson Genomics & Bioinformatics (2023)
- CITI Program: Lab Animals; Working with Fish; Zoonotic Training; Basic Course for Investigators (2023)
- Animal welfare/testing with fish — GMA, Büsum, Germany (2020)
- Histopathology — EAFP workshop, Porto (2019)
- SERB-sponsored national workshops in genomics, research methodology, biotech skills (2016–2017)

TECHNICAL EXPERTISE

Genome editing & Transgenesis: CRISPR/Cas9 RNPs, guide design (CHOPCHOP), Tol2 reporters.

Imaging & Quantitative Microscopy: Live/confocal imaging, FIJI workflows, colocalization (JACoP), scale-bar/overlay pipelines.

Molecular Biology: PCR/qPCR, cloning, RNA isolation/cDNA, MFQPCR (Fluidigm), gene expression analysis.

Protein/Glyco Methods: ELISA, Western blot, SDS-PAGE, chromatography; O-GlcNAc profiling.

Microbiology/Immunology: Zebrafish infection assays (*A. fumigatus*, *M. marinum*), CFU, survival, dye-based ROS/acidification readouts (Lysotracker, CellROX).

Cell Culture: Primary fish HK leukocytes; CHSE-214, RTgill-W1; stimulation with fungal PAMPs/pathogens.

Software: R (tidyverse, survival, emmeans), ImageJ/FIJI, MEGA, Clustal, LightCycler, Cytoscape.

GRANTS, FELLOWSHIPS & SUPPORT (SELECTED)

- World Bank Robert S. McNamara Fellowship (Germany Ph.D. research)
- CSIR-UGC JRF/SRF (India)
- DST-SERB / University Travel Grants (Portugal EAFP conference)

SERVICE & OUTREACH

- Teaching Assistant & Subject Expert, SWAYAM MOOC (Molecular Biology) and EMMRC e-content (2016–2018)

CONTRIBUTIONS TO SCIENCE

Defining the Drivers of Aquaculture Fungal Disease

My Ph.D. work at the University of Kashmir (2015–2021) addressed the persistent problem of microbial infections in aquaculture systems of Kashmir. The regional diversity of fish-associated fungi was unknown, limiting disease control strategies. Through extensive sampling and PCR-based sequencing, I identified 21 pathogenic fungal species affecting cultured rainbow trout and carp, several of which were also human opportunists. Using SEIR (Susceptible–Exposed–Infected–Recovered) modeling integrated with histopathology and microbiological assays, I characterized infection dynamics and identified *Mucor hiemalis* and *Saprolegnia delica* as dominant pathogens. The models accurately predicted outbreak patterns, leading to management interventions such as optimized temperature control and targeted antifungal treatments that reduced mortality. This integrative approach yielded three first-author papers in *Microbial Pathogenesis* and *Aquaculture*, a first-author review in *Fungal Biology Reviews*, and a co-authored review on antimicrobial peptides in *Microbial Pathogenesis*. These studies established a molecular and ecological framework for fungal pathogen surveillance in freshwater aquaculture.

Key references: Magray et al., 2021; Magray et al., 2020a, b; Magray et al., 2019; Shabir et al., 2018.

Uncovering Host Antifungal Immune Mechanisms in Fish

During my Robert S. McNamara Fellowship (2019–2020) at the Leibniz Institute for Farm Animal Biology, Germany, I investigated how salmonid immune cells detect fungal pathogens. RNA-seq and

qPCR profiling of head-kidney leukocytes and CHSE cells stimulated with *Mucor hiemalis*, *Saprolegnia delica*, and purified PAMPs revealed transcriptional modules governing innate recognition and effector activation. *M. hiemalis* strongly induced *CLEC18A*, *TLR22*, *IL6*, *TNF*, and *LEAP2*, accompanied by transient leukocyte apoptosis that resolved within 24 h. Flow cytometry and microscopy confirmed pathogen-specific immune signatures and phagocyte–fungus interactions. This work defined early immune markers of fungal recognition and demonstrated that *M. hiemalis* acts as a potent immunostimulant, advancing understanding of vertebrate antifungal immunity and guiding future resistance or vaccine studies.

Key reference: Magray et al., 2022.

Dissecting Macrophage–Aspergillus Interactions In Vivo

To elucidate how macrophages restrict *Aspergillus fumigatus* in vivo, I used a larval zebrafish model combining live confocal imaging and CRISPR/Cas9-based gene editing. Targeting the v-ATPase subunit *atp6v1h* revealed that loss of phagosomal acidification leads to uncontrolled spore germination and hyphal invasion, phenocopying macrophage-deficient mutants. Complementary Bafilomycin A₁ treatments and analyses of *LAMP1/2* and cathepsin mutants confirmed that phagolysosomal acidification, rather than direct microbicidal activity, is critical for halting fungal transition. These findings redefine macrophage antifungal defense as dependent on v-ATPase-driven maturation of the phagolysosome. The study forms the basis of my first-author preprint (bioRxiv 2025) now under review at *Journal of Cell Biology* and extends to broader regulatory networks governing phagosome function.

Manuscript under review: Magray A.R., and Rosowski E.E., 2025 *bioRxiv* [Preprint].