VISHNU RAGHURAM

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OBJECTIVE

PhD candidate in the Microbiology and Molecular Genetics program at Emory University, GA, USA expecting to graduate in July 2023. Looking for research opportunities involving bacterial genomics, population genetics and evolutionary biology. My primary research interests are to study the evolution of virulence in bacteria using large-scale genomics data and to develop methods for genotypic and phenotypic characterization.

EDUCATION

- **Emory University –** Atlanta, GA: PhD, Microbiology and Molecular Genetics   Aug 2019 – Present
- **Georgia Institute of Technology –** Atlanta, GA: MS. Bioinformatics   Aug 2017 – Dec 2018
- **SRM University –** Chennai, Tamil Nadu, India: B. tech Biotechnology   Aug 2012 – May 2016

RESEARCH & TRAINING

PhD Student – Emory University, Atlanta, GA, USA   Apr 2019 – Present
Mentor: Dr. Timothy Read and Dr. Joanna Goldberg

- Developed a software tool called 'AgrVATE' (*agr* Variant Assessment and Typing Engine) to genotype the *agr* quorum sensing system in *S. aureus* and identify mutations - https://github.com/VishnuRaghuram94/AgrVATE/
- Developed a software tool called 'LIVID' (Locus specific Variant IDentifier) for extracting a locus from any given bacterial genome sequence using *in-silico* PCR and identifying variants when compared to a corresponding reference sequence - https://github.com/VishnuRaghuram94/LIVID/
- Characterized the genetic diversity and evolution of quorum sensing in *S. aureus* and their role in single and polymicrobial infections using computational biology and molecular biology approaches
- Identifying antibiotic resistance profiles, MRSA reoccurrence and other genetic markers indicating virulence using data from whole genome sequences of human-isolated *S. aureus* strains from multiple body sites
- Building a species-wide representative dataset of *S. aureus* genomes from 85,000 publicly available sequences for analysis of mutational signatures, pangenomes, and lineage specific markers.

Visiting student –CU Anschutz, Aurora, CO, USA   Aug 2022 – Sep 2022
Supervisor: Dr. Alexander Horswill

- Trained in *Staphylococcal* molecular cloning to generate mutant *S. aureus* strains having heterologous *agr* quorum sensing genotypes
- Performed and taught basics of R, bacterial genome analysis and comparative genomics for graduate students and postdocs in the lab

Rotation student – Emory University, Atlanta, GA, USA   Sep 2019 – Mar 2020
- o _**Mentor**: Dr. Joanna B. Goldberg_
  - Designed and constructed reporter plasmids to identify novel regulators of virulence factor *prpL* using molecular cloning.
- o _**Mentor**: Dr. Timothy Read_
  - Computationally characterized diversity of the Agr operon in *S. aureus* using a database with 43,000 whole genomes.
  - Established RNA extraction and RT-qPCR protocols to study regulation of delta-hemolysin in *S. aureus*.
- o _**Mentor**: Dr. Bernardo Mainou_
  - Purified recombinant T1L and T3D reovirus strains and quantified their attachment, cytotoxicity, and infectivity against MDA-MB-231 and MDA-MB-436 triple-negative breast cancer cell lines using cell culture-based assays, flow cytometry and microscopy techniques.

Research Specialist – Emory University, Atlanta, GA, USA   Apr 2019 – Aug 2019
**Mentor**: Dr. Joanna B. Goldberg
- o Quantified temperature dependent regulation of virulence factor *prpL* in clinical isolates of *P. aeruginosa* using RT-qPCR.
- o Developed assay for quantifying T6SS dependent killing in various *P. aeruginosa* isolates.
- o Performed genomic and transcriptomic analyses of *S. aureus* and *P. aeruginosa* strains to identify genetic determinants of virulence-related phenotypes.

Master's Student – Georgia Institute of Technology, Atlanta, GA, US   Aug 2017 – Dec 2018
- o _**Mentor**: Dr. Brian Hammer_ (Graduate Research Assistant)
  - Conducted coculture assays of *Vibrio cholerae* and fish commensal bacteria to observe outcomes of bacterial competition.
  - Performed hybrid genome assembly of an environmental *V. cholerae* strain to identify novel T6SS auxiliary cluster alleles.
  - Computationally characterized VgrG proteins in *V. cholerae* and other related species to examine effector diversity.
- o _**Professor**: Dr. Fredrik Vannberg_ (Advanced Human Computational Genomics course)
  - Performed comparative analysis of human genome contamination identification tools to estimate abundance of pathogenic reads in clinical human genome sequences
- o _**Professor**: Dr. King Jordan_ (Computational genomics course)
  - Tested *de novo* and reference-based genome assembly tools on 252 *Klebsiella sp.* Isolates to build an assembly pipeline and identify genetic determinants of antibiotic hetero-resistance

Intern – Rajiv Gandhi Centre for Biotechnology, Kerala, India   Sep 2016 – Mar 2017
  - Trained in basic bioinformatics techniques such as whole genome assembly, annotation, variant calling and ChIP-seq and RNAseq analysis.
  - Trained in basic Bash, Python, Perl and R scripting for data processing and visualization.

Undergraduate Researcher – SRM University, Tamil Nadu, India   Aug 2015 – May 2016
Mentor: Dr. E. Berla Thangam
  - Measured upregulation of NLRP3 inflammasome pathway in response to bacterial ligands to study neonatal sepsis.
  - Quantified histamine induced expression of H1 and H4 receptors in human mast cell line HMC-1.

Intern - Life cell International, Tamil Nadu, India   June 2014 – July 2014
  - Isolated mesenchymal stem cells from umbilical cord tissue.
  - Differentiated peripheral blood monocytes into dendritic cells.

PUBLICATIONS

- Bernardy EE, **Raghuram V**, Goldberg JB. Staphylococcus aureus and Pseudomonas aeruginosa Isolates from the Same Cystic Fibrosis Respiratory Sample Coexist in Coculture. Microbiol Spectr. 2022 Aug 31;10(4):e0097622. doi: 10.1128/spectrum.00976-22. Epub 2022 Jul 18. PMID: 35867391; PMCID: PMC9431432. (**Co-first author**)

- **Raghuram V**, Alexander AM, Loo HQ, Petit RA 3rd, Goldberg JB, Read TD. Species-Wide Phylogenomics of the Staphylococcus aureus *Agr* Operon Revealed Convergent Evolution of Frameshift Mutations. Microbiol Spectr. 2022 Feb 23;10(1):e0133421. doi: 10.1128/spectrum.01334-21. Epub 2022 Jan 19. PMID: 35044202; PMCID: PMC8768832.

- Cross AR, **Raghuram V**, Wang Z, Dey D, Goldberg JB. Overproduction of the AlgT Sigma Factor Is Lethal to Mucoid Pseudomonas aeruginosa. J Bacteriol. 2020 Sep 23;202(20)PubMed PMID: 32747430; PubMed Central PMCID: PMC7515251.

- Rodríguez Stewart RM, **Raghuram V**, Berry JTL, Joshi GN, Mainou BA. Noncanonical Cell Death Induction by Reassortant Reovirus. J Virol. 2020 Oct 27;94(22):e01613-20. doi: 10.1128/JVI.01613-20. PMID: 32847857; PMCID: PMC7592226.

- Bernardy EE, Petit RA 3rd, **Raghuram V**, Alexander AM, Read TD, Goldberg JB. Genotypic and Phenotypic Diversity of Staphylococcus aureus Isolates from Cystic Fibrosis Patient Lung Infections and Their Interactions with Pseudomonas aeruginosa. mBio. 2020 Jun 23;11(3)PubMed PMID: 32576671; PubMed Central PMCID: PMC7315118.

- Cross AR, Csatary EE, **Raghuram V**, Diggle FL, Whiteley M, Wuest WM, Goldberg JB. The histone-like protein AlgP regulon is distinct in mucoid and nonmucoid Pseudomonas aeruginosa and does not include alginate biosynthesis genes. Microbiology (Reading). 2020 Sep;166(9):861-866. PubMed PMID: 32634088.

- o **Raghuram V**, Goldberg JB. Draft Genome Sequences of Eight Pseudomonas aeruginosa Corneal Infection Isolates. Microbiol Resour Announc. 2020 Jan 2;9(1)PubMed PMID: 31896638; PubMed Central PMCID: PMC6940290.
- o Crisan CV, Chande AT, Williams K, **Raghuram V**, Rishishwar L, Steinbach G, Watve SS, Yunker P, Jordan IK, Hammer BK. Analysis of Vibrio cholerae genomes identifies new type VI secretion system gene clusters. Genome Biol. 2019 Aug 12;20(1):163. PubMed PMID: 31405375; PubMed Central PMCID: PMC6691524.

CONFERENCES

- o **ASM NGS 2022, Baltimore, MD, USA – Poster:** '*Detecting within-host diversity of Staphylococcus aureus during colonization: "Pool" genomes vs. Individual genomes.*'
- o **Ecology and Evolution of Infectious Diseases 2022, Atlanta, GA, USA – Poster:** '*A 40,000 genome view of the Staphylococcus aureus quorum sensing system.*'
- o **STAPH 2022** *Staphyloccal* **infections, virtual – Attendee**
- o **Emory University GDBBS Symposium 2022, Atlanta, GA, USA – Poster:** '*Detecting within-host diversity of Staphylococcus aureus* during colonization.'
- o *Pseudomonas 2022* **International biennial conference, Atlanta, GA, USA - Attendee**
- o **ASM Southeast 2021, virtual – Talk:** '*Species-wide genomic analysis of the Staphylococcus aureus agr quorum sensing operon shows convergent evolution of frameshift mutations, leading to evolutionary-dead ends.*'
- o **ASM Southeast 2018, Atlanta, GA, USA – Poster:** '*Investigating the role of Vibrio cholerae T6SS in altering fish gut microbial communities.*'
- o **ASM Microbe 2018, Atlanta, GA, USA – Poster talk:** '*Understanding VgrGs: A Bioinformatics Approach.*'

AWARDS

- o **Laney Graduate Student Council Travel award 2022** – Up to 250 US$ for conference travel related expenses.
- o **ASM NGS 2022 Travel award** – Free conference registration (380 US$)
- o **Infectious Diseases Across Scales award of distinction** – Emory University, Fall 2022 – Fall 2023 – 2000 US$ award for research expenditures.
- o **Laney Graduate School fellowship award** – Emory University, Fall 2019 – Fall 2024 – Additional 2500 US$ stipend for up to 5 years.
- o **Graduate Research Assistantship Award** – Georgia Institute of Technology, Fall 2018 – Full tuition waiver + 900 US$ monthly stipend.
- o **Graduate Research Assistantship Award** – Georgia Institute of Technology, Summer 2018 – Full tuition waiver + 900 US$ monthly stipend.
- o **Graduate Research Assistantship Award** – Georgia Institute of Technology, Spring 2018 – Full tuition waiver + 900 US$ monthly stipend.

ADDITIONAL EXPERIENCE

o **Attended 3-day workshop on Nextflow and nf-core** – Virtual, 2022

o **Vice president of Data Visualization and Analysis Club** – Emory University, 2021 – 2022
  - Organized and conducted workshops on basic command line usage, introduction to bacterial genomics and basics of graphing techniques

o **Teaching assistant for Introduction to Virology course** – Emory University, 2020

o **Trained an undergraduate student** on microbial culture techniques and bacterial co-culture assays – Georgia Institute of technology, 2018.

o **Reviewed undergraduate research proposals** for 'President's Undergraduate Research' Awards – Georgia Institute of technology, 2018.

o **Facilitated international student exchange programs** through student collaborations – SRM University, 2015.