EBENEZER AMARE - Aspiring Physician-Scientist pursuing regenerative medicine and global health equity

yoseph@unc.edu ebenezeramare.com 571-635-2546

EDUCATION

University of North Carolina – Chapel Hill (Joint BME with NC State) *Aug 2023 – May 2027*

Bachelor of Science in Biomedical Engineering (BME) and Neuroscience; Minor in Chemistry *GPA: 3.768*

Specializations – Regenerative Medicine and Medical Microdevices *MCAT: 523 (99th percentile)*

Relevant Coursework –Writing in Medicine, Mechatronics, Materials Science, BME Design and Manufacturing I-III, Biomedical Electronics, Cellular Biology, Molecular Genetics, Genetic Engineering, Bioinstrumentation

HONORS & AWARDS

BME Department Scholarship – Inaugural annual BME Department grant for anonymously nominated students

Jackie Overton Carolina Scholar - UNC alumni grant for financially insecure and academically excelling students

Abrams Scholars – UNC-funded BME award for research in transcriptional regulators of intestinal stem cells

NC Fellows – Community-centered leadership development program with Junior summer research stipend

Honors Carolina – Highly selective academic program with priority access to Honors classes, seminars, and resources

Ron Brown Captains Program – Top 5% of applicants; member of the Ruth-Norman Rales Leader Network

National Pan-Hellenic Council – Nominated for and won one of two Black Scholar awards for high school seniors

RESEARCH EXPERIENCE

SensUs Competition Team – Raleigh, NC Nov 2025 – Present

BioInterface Lab

- Designing a continuous non-enzymatic levodopa OECT (Organic Electrochemical Transistor) biosensor with conjunctive triple-element gate recognition (boronic acid polymer, cationic polymer, in situ ZnO nanoparticles) for Parkinson's disease management, targeting the SensUs 2026 international competition in Eindhoven
- Synthesizing functional acrylamide copolymers (poly(AAm-co-AAPBA), poly(AAm-co-APTAC)) via thermal initiated free radical polymerization, characterizing composition by ^{1}H NMR, analyzed via Bruker TopSpin, and validating deposition and Levodopa binding through cyclic voltammetry to find functionalization techniques that leads to substantial decreases in current, differential pulse voltammetry to test strength of binding of successfully functionalized electrodes, and electrochemical impedance spectroscopy for additional polymer characterization
- Characterizing PEDOT:PSS OECT devices through transfer and output curve acquisition using a Keithley 2602B SMU, extracting transconductance and identifying optimal operating parameters via Python-based numerical differentiation; validated gate functionalization by cyclic voltammetry prior to OECT integration
- Developing a pharmacokinetic deconvolution algorithm to translate continuous peripheral ISF levodopa signals into clinically actionable dosing recommendations, using temporal PK curve shape to discriminate levodopa from interference metabolites like 3-O-methyldopa across a three-gate OECT array readout
- Conducting stakeholder discovery interviews across neurology, geriatrics, allied health, pharmaceutical industry, and patient populations; developed full regulatory pathway, Medicare/Medicaid reimbursement framework, and B2B clinical decision-impact validation study design for the Translation Potential award

UNC Center for Gastrointestinal Biology and Disease - Chapel Hill, NC Oct 2024 – Present

Abrams Research Scholar/ Magness Lab

- **Honors Thesis (BMME 691H & 692H):** Engineering a transwell intestinal epithelial culture system with an integrated phosphorescence-based photonic biosensor (iPOB) to establish and quantify real-time oxygen gradients, induce "differentiation zones" using basal media with stem cell factors, and characterize organoid hypoxic niche dynamics, with applications to IBD pathophysiology and therapeutic screening.
- Researched the relationship between oxidative respiration and expression of transcription factor (TF) SOX9 in intestinal stem cells (ISCs) under the guidance of Dr. Joseph Burclaff. Following identification of 38 TFs with

EBENEZER AMARE - Aspiring Physician-Scientist pursuing regenerative medicine and global health equity

yoseph@unc.edu ebenezeramare.com 571-635-2546

significantly altered expression through multi-omics analyses, genetically engineered ISC lines with EGR1 (upregulated) and HNF4G (downregulated), alongside Mito-TagRFP for live-cell mitochondrial imaging. Validated successful electroporation through immunostaining and quantification of fluorescence intensity.

- Optimized the platform for Seahorse and other bioenergetics assays, gaining skill in passaging 3 µL organoids in Matrigel, fluorescence imaging, and metabolic data analysis. Executed Mito Stress Test assays across wild-type, SOX9-knockout (KO), SOX9-overexpression (OE), and SOX9-KOOE lines, finding that SOX9 loss elevates total respiratory and glycolytic activity while its reintroduction in a KO background suppresses both, and authored the lab's standard operating procedures for organoid plating, Flex Plate assays, and CyQUANT normalization. Presented this work at the UNC BME Symposium and the CGIBD Annual Symposium.

Center for Environmental Medicine, Asthma and Lung Biology –Chapel Hill, NC Aug 2024 – Oct 2024

Work Study/ Jaspers Lab

- Conducted comprehensive research on environmental and demographic factors affecting respiratory health at CEMALB, focusing on a 26-year-old patient dataset. Key projects include a demographic stratification & time-based analysis of 750 patients using R Studio and a time-based analysis to assess the correlation between global warming and allergy severity. Additionally, designed and 3D printed a 12-well plate using OnShape, utilizing an expandable, breathable resin to optimize material properties for advanced respiratory research.

National Institutes of Health –Rockville, MD May 2024 – Aug 2024

National Center for Advancing Translational Sciences/ Stem Cell Translation Laboratory/ Summer Research Intern [SIP]

- Researched mechanisms of chronic pain [HEAL Initiative] with Dr. David Castellano in the premier NIH Stem Cell Lab by learning and optimizing hPSC-derived sensory neuron differentiation (improving differentiation efficiency while maintaining cell viability) while assisting with MEA and patch clamp EEG recordings.
- Validated high-value proteins from mass spectrometry using a machine learning pain genes database and characterized proteins up/downregulated in response to a 4-part inflammatory cocktail – particularly the plasma membrane receptor DCC, which binds to netrin-1, an axonal guidance molecule, and is critical for axonal elongation, which has previously been shown to cause inflammatory sensitization in mice - using Western Blot and Immunocytochemistry [2 poster days]; lastly, I mined DCC's downstream signaling pathways and found two proposed inflammatory pathways that were utilized in an August grant application.
- Completed coursework in Preclinical Translational Science and in R Studio for Multi-Omics Analysis

RESEARCH & TECHNICAL PROJECTS

BMME 511 & 398: Genetic Engineering and Sophomore Design Lab Jan 2026 – May 2026

- Developed complete NIH F31 Predoctoral Fellowship grant proposal investigating CRISPRa-Mediated Metabolic Stabilization of Directly Differentiated iPSC-Derived Proximal Tubule Cells for Bioartificial Kidney Devices
- Designed implantable bioartificial kidney CAD model that would incorporate said proximal tubule cells in biocompatible housing for chronic kidney disease treatment, integrating microfluidic oxygen gradients and waste filtration systems

BMME 575 & COMP 116: Machine Learning for Biosignals – Chapel Hill, NC Aug 2025 – Dec 2025

- Developing deep learning models for [ECG/EEG/EMG/biosignal type] classification achieving [X%] accuracy using [convolutional neural networks / recurrent neural networks / transformer architectures]
- Applying signal processing techniques and feature extraction methods for real-time wearable diagnostic applications in [cardiac monitoring / seizure prediction / motor disorder detection]

BMME 581: Biomanufacturing & Quality Systems – Chapel Hill, NC Aug 2025 – Dec 2025

- Designing scalable bioreactor incorporating Six-Sigma quality control protocols and FDA cGMP (current Good Manufacturing

EBENEZER AMARE - Aspiring Physician-Scientist pursuing regenerative medicine and global health equity

yoseph@unc.edu ebenezeramare.com 571-635-2546

Practice) guidelines for therapeutic cell production

- Developing process optimization strategies for [iPSC expansion / organoid culture / herapeutic protein production] with focus on reproducibility and regulatory compliance

NSCI 278: Molecular Brain Imaging – Chapel Hill, NC Jan 2026 – May 2026

- Investigated sex differences in VGLUT2 co-expression within A1 noradrenergic neurons using double immunofluorescence labeling in transgenic eGFP-reporter mice, quantifying fluorescence intensity across male and female cohorts via ImageJ mask-based analysis
- Presented findings at the **2026 UNC OUR Celebration of Undergraduate Research Symposium**; results contributed baseline molecular characterization of A1 heterogeneity motivating future sex-balanced neuroscience studies

CHEM 262L: Organic Chemistry Laboratory II – Chapel Hill, NC Jan 2026 – May 2026

- Synthesized an unsymmetrical triarylpyrylium photoredox catalyst via two parallel aldol condensation/acid-catalyzed cyclization routes through distinct chalcone intermediates; characterized via ^{1}H NMR, UV-visible and fluorescence spectroscopy, and cyclic voltammetry to determine excited-state reduction potential ($E^*_{1/2} = +2.50$ V vs. SCE) using the Rehm-Weller equation, then validated thermodynamic feasibility by driving visible-light-mediated oxidation of 1-phenylethanol to acetophenone

EDUC 318, 317 & 309: Education Policy Research & Data Analysis — Chapel Hill, NC — Jan 2025 – May 2025

- Conducted statewide longitudinal analysis of NC public school data (2014–2024) examining the causal effect of STEM designation on socioeconomic achievement gaps across 2,396 schools w/ difference-in-differences, multilevel modeling, and causal forest methods
- Identified statistically significant gap reduction of 0.30 standard deviations in high-poverty schools (EDS ≥ 60%) following STEM designation as a structural equity policy failure, among other findings
- Presented research findings to NC Fellows leadership and developed actionable policy recommendations for STEM designation reform targeting high-poverty districts including Greene, Rowan-Salisbury, and Gaston counties

CLINICAL EXPERIENCE

CareYaya –Research Triangle, NC Aug 2024 – Present

Patient Care Technician

- Supported elderly and neurodegenerative disease patients with mobility, including hourly body adjustments to prevent ulcers, safe transitions, and therapeutic exercises prescribed by physical and occupational therapists
- Facilitated cognitive engagement by organizing mentally stimulating activities (puzzles, reading, conversation about their pasts), balancing assistance with encouragement of patient independence to preserve dignity
- Advocated for patients to receive medication and necessary attention in understaffed caretaking homes

Minority Association for Premedical Students: Shadowing Program –Chapel Hill, NC Sep 2025 – Present

Program Founder and Director (16 shadowing hours)

- Founded UNC MAPS' first structured shadowing program to increase access for underrepresented premedical students through building partnerships with UNC Pediatrics and SNMA to secure mentors and clinical placement
- Managed applications, scheduling, and onboarding while developing standardized program policies

UNC Kidney Center –Chapel Hill, NC Jun 2025 – Sep 2025

North Carolina Kidney Technology Incubator (NC-KTI) Program (15 shadowing hours)

- Inspired by my mom (a dialysis nurse) to investigate nephrology, I engaged in "Kidney Conversations" with nephrologists on kidney biology, gaps in treatment, and various perspectives, e.g., equitable kidney care access. I've shadowed kidney transplants, vascular access surgery with Dr. Saad Shariff, and large dialysis plants are forthcoming, and in August, we will begin research projects to address a gap in nephrology with a UNC lab.

EBENEZER AMARE - Aspiring Physician-Scientist pursuing regenerative medicine and global health equity

yoseph@unc.edu ebenezeramare.com 571-635-2546

Children's National Hospital – Washington, DC May 2024 – Jun 2024

Department of Pain Medicine and Anesthesiology Observership (24 shadowing hours)

- Facilitated by Dr. Tamanda Douglas, I was accepted to shadow (cardiac) pediatric anesthesiologists in urology, neurosurgery, ENT, general, and cardiac surgery. I attended lectures by attendings like Dr. Andrew Waberski and Dr. Jeremy Deer. Through this, I gained hands-on insights into procedures from biopsies to cranioplasties, solidifying my commitment to a medical career. More in "An Ultimate Confirmation" on my blog site.

UNC Hospitals Ambulatory Care Center –Chapel Hill, NC Apr 2025 – Dec 2025

Neurosurgery Clinic (12 shadowing hours)

- Following UNC's application process, I was accepted to shadow neurosurgeons as they discussed diagnoses, evaluated imaging to determine if surgery was necessary, and followed up with patients post-operation. Having experienced the adrenaline of the OR, I formed a more holistic understanding of surgery and found an approach to patient interaction I aim to emulate from Dr. Upadhyaya. Through Dr. Vibhor Krishna and Dr. Dominique Higgins, I gained insight into balancing surgery and research, which I aim to maintain as a physician-scientist.

POSTERS & PRESENTATIONS

Center for Gastrointestinal Biology & Disease (CGIBD) Scientific Symposium – Research Triangle, NC June 2026

Poster: *Characterizing Novel Transcriptional Regulators of Mitochondria in Human Intestinal Stem Cells*

Lampe Joint Biomedical Engineering (BME) Poster Symposium – Durham, NC April 2025

Poster: *Identifying Novel Transcriptional Regulators of Mitochondria in Human Intestinal Stem Cells*

National Institutes of Health (NIH) Summer Poster Day – Bethesda, MD June 2024

Poster: *Characterization of Netrin-1 Receptor DCC in Human Pluripotent Stem Cell-Derived Sensory Neurons During Inflammatory Sensitization*

TJ Science and Technology Research (STAR) Symposium – Alexandria, VA May 2022

Presentation: *Optimization of Durability and Biodegradability of C. Vulgaris Starch-Based Bioplastic*

LEADERSHIP & COMMUNITY INVOLVEMENT

Minority Association for Premedical Student: UNC Chapter – Chapel Hill, NC May 2024 – Present

President & former SNMA (Students National Medical Association) Liaison

- Oversee MAPS alongside Favor Asbore
- Organized joint MAPS-SNMA events which facilitate mentorship, premedical workshops, & med school tours, alongside other UNC medical school opportunities and local health equity volunteer work to provide to members
- Worked 2 years with physicians, med students, and co-SNMA liaisons to establish MAPS' inaugural shadowing program in a variety of Pediatric subspecialties for low-income, underrepresented students with no prior exposure, and have facilitated 400 shadowing hours for 8, then 17 students in our first and second cohorts, respectively.

Student Health Action Coalition – Carrboro, NC Aug 2025 – Present

Spanish Translator

- Served as a Spanish medical interpreter for underserved patients in SHAC's free community health clinic
- Provided real-time translation while supporting front-desk check-ins, escorting patients to exam rooms, gathering medical histories and symptom descriptions, and assisting medical students as they delivered treatment plans and medication instructions. This work helped facilitate culturally competent care and offered insight into accessible,

EBENEZER AMARE - Aspiring Physician-Scientist pursuing regenerative medicine and global health equity

yoseph@unc.edu ebenezeramare.com 571-635-2546

community-based healthcare.

STEM and Premedical Mentorship Programs (InnovaXcell,) – Various Counties, NC Dec 2025 – Present

Mentor and Curriculum Developer; Founding Member

- Orchestrating Lab shadowing program for incoming UNC students alongside four other founding members
- Established InnovaXcell's first cohort of 28 students weekly at Phoenix Academy (alternative) High School to increase early access to research for underrepresented minority and low-income NC students

North Carolina Fellows – Chapel Hill, NC Apr 2024 - Present

Admissions Committee

- Completed a capstone research project evaluating equity gaps in access to shadowing, research, and mentorship
- Reviewed applications for the NC Fellows Program to help selected those admitted to the cohorts of 2028-30
- Employed strategic leadership practices to initialize the East African Student Org (EASO) Executive Board

Helping Hand Project –Chapel Hill, NC Aug 2023 – Feb 2025

Innovation Team and Design Team

- CAD designing and printing out custom-made prosthetic arms/hands for low-income inquirers
- Developing a model for autonomous hand prosthetics using OpenSCAD on Innovation Team

SKILLS & CERTIFICATIONS

Languages: Amharic, Spanish

Technical Skills: MATLAB, ODE modeling, CSS, HTML, VS Code, WordPress, Arduino (C/C++), Python, Java, Linux Commands, Printed Circuit Board Design, ArcGIS, 3D CAD design (OnShape & AutoCAD), OpenSCAD, 3D Printing, Laser Cutting, Technical Writing, Linear Algebra, Jupyter Notebook, Excel

Laboratory Skills: Seahorse Bioenergetics Assay, Genetic Engineering, Cell [Organoid] Culture, Fiji-J, Western Blot, hPSC Differentiation, R Studio, Immunocytochemistry, Multi-omics Data Analysis, ELISAs, Gel Electrophoresis, Multi-Electrode Array, Plastic Film Production, Water Quality Testing

Certifications: IBM Qisket Quantum Computing**;** NIH Principles of Preclinical Translational Science, NIH Fundamentals of Omics Data Analysis; NCMW Mental Health First Aid; AHA Basic Life Support