

Nicole Sarna

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EDUCATION

PhD in Biomedical Engineering Aug. 2021-Present
Vanderbilt University Nashville, TN
Cumulative GPA: 4.0/4.0

BS in Biomedical Engineering, Magna Cum Laude Aug. 2017-May 2021
University of Florida Gainesville, FL
Cumulative GPA: 3.58/4.0 | Major GPA: 3.92/4.0

RESEARCH EXPERIENCE

Graduate Research Fellow Aug. 2021-Present
Vanderbilt University Nashville, TN

Advisor: Michael R. King, PhD, Department of Biomedical Engineering

- Evaluating the long-term behavior of T cells following exposure to fluid shear stress
- Engineering third-generation chimeric antigen receptor (CAR) T cells targeting prostate specific membrane antigen (PSMA)
- Enhancing *ex vivo* activation of CAR T cells to improve persistence and cytotoxicity at solid tumor sites following Adoptive Cell Transfer (ACT)

Undergraduate Student Researcher Jul. 2019-Aug. 2021
University of Florida Gainesville, FL

Advisor: Carlos M. Rinaldi-Ramos, PhD, Department of Chemical and Biomedical Engineering

- Characterized super-paramagnetic iron oxide nanoparticles (SPIONs) for *in vivo* imaging applications in the context of cancer immunotherapy
- Evaluated the sensitivity and resolution of in-house synthesized SPIONs using the MOMENTUM™ Magnetic Particle Imaging (MPI) system
- Performed *in vivo* experiments to monitor and track the biodistribution of T cells following Adoptive Cell Transfer (ACT) in breast cancer and glioblastoma murine models
- Developed MATLAB programs to analyze MPI and fluorescence microscopy data sets

Research & Development Intern Sept. 2020-Mar. 2021
Lucere Laboratories Gainesville, FL

Supervisor: Atticus Steinmetz, CEO

- Optimized the synthesis of D-Luciferin, a bioluminescent compound, to ensure clean, efficient, and more affordable production
- Conducted market research to validate and prioritize new product offerings
- Identified and communicated internationally with D-Luciferin users to form research collaborations

Undergraduate Student Researcher Jan. 2020-May 2020
University of Florida Gainesville, FL

Advisor: Todd E. Golde, MD, PhD, Department of Neuroscience

- Developed MATLAB program to analyze fluorescent images of 3D *ex vivo* brain slice cultures that exhibit aggregation of tau protein, a primary marker of Alzheimer's and other neurodegenerative diseases

Undergraduate Student Researcher Sept. 2017-Dec. 2018
University of Florida Gainesville, FL

Advisor: Norman Fitz-Coy, PhD, Department of Neuroscience

- Collaborative research project, DebrisSat, between NASA, The Aerospace Corporation, and the US Air Force Space and Missile Systems Center
- Collected data to update NASA's Standard Breakup Model using Orbital Debris Modeling
- Analyzed and characterized space debris fragments generated by hypervelocity collision on a model satellite

HONORS/AWARDS

- 2nd Place Poster Presentation – The Vanderbilt Center on Mechanobiology Inaugural Retreat Aug. 2022
- 1st Place Poster Presentation – NIH/NCI Tissue Engineering Collaborative (TEC) Meeting July 2022
- **National Science Foundation (NSF) Graduate Research Fellowship Program (GRFP)** Apr. 2022-Present
- Outstanding Undergraduate Research Award Apr. 2021
- Bright Futures Florida Academic Scholarship Aug. 2017-May 2021
- Valedictorian at Winter Park High School 2017

PATENTS

- PCT International Patent Application (PCT/US2022/073015):
“Fluid Shear Stress for Ex Vivo Activation of Immune Effector Cells”. Filed: June 17th, 2022.
Inventors: King, MR, Hope, JM, Dombroski, JA, **Sarna, NS**.

PUBLICATIONS

- Knoblauch, SV, Desai, SH, Dombroski, JA*, **Sarna, NS**, Hope, JM, King, MR. “**Chemical and Mechanical Activation of Piezo1 Enhance TRAIL-Mediated Apoptosis in Glioblastoma Cells**” Nov. 2021, (*in review*)
- **Sarna, NS***, Marrero-Morales, L*, DeGroff, R*, Rivera-Rodriguez, A, Lui, S, Chiu-Lam, A, Good, H, Rinaldi-Ramos, CM. “**An anatomically correct 3D printed mouse phantom for magnetic particle imaging studies**” *Bioengineering & Translational Medicine*, 2022; <https://doi.org/10.1002/btm2.10299>
- Dombroski, JA*, Hope, JM*, **Sarna, NS**, King, MR. “**Channeling the Force: Piezo1 mechanotransduction in cancer metastasis**” *Cells*, 2021; 10(11):2815. <https://doi.org/10.3390/cells10112815>
- Rivera-Rodriguez, A, Hoang-Minh, L, Chiu-Lam, A, **Sarna, NS**, Marrero-Morales, L, Mitchell, D, Rinaldi-Ramos, CM. “**Tracking Adoptive T Cell Immunotherapy Using Magnetic Particle Imaging**” *Nanotheranostics*, 2021; 5(4):431-444. <https://doi.org/10.7150/ntno.55165>
- Lui, S*, Rivera-Rodriguez, A*, Chiu-Lam, A*, DeGroff, R, Savliwala, S, **Sarna, NS**, Rinaldi-Ramos, CM. “**Long Circulating Tracer Tailored for Magnetic Particle Imaging**” *Nanotheranostics*, 2021; 5(3):348-361. <https://doi.org/10.7150/ntno.58548>

CONFERENCES & PRESENTATIONS

- [Poster] **Sarna, NS**, Hope, JM, Desai, S, & King, MR. “Enhanced T Cell Activation via Fluid Shear Stress”, **The Vanderbilt Institute of Nanoscale Science and Engineering (VINSE) Annual Meeting, Nashville, TN** (Nov. 2022)
- [Oral] **Sarna, NS**, Hope, JM, Desai, SH, & King, MR. “Enhanced and Sustained T Cell Activation Over Time via Fluid Shear Stress Exposure”, **Biomedical Engineering Society (BMES) Annual Meeting, San Antonio, TX** (Oct. 2022)
- [Poster] **Sarna, NS**, Marrero-Morales, L, DeGroff, R, Rivera-Rodriguez, A, Lui, S, Chiu-Lam, A, Good, H, Rinaldi-Ramos, CM. “An Anatomically Correct 3D-Printed Mouse Phantom for Magnetic Particle Imaging Studies”, **World Molecular Imaging Congress (WMIC) Annual Meeting, Miami, FL** (Sept. 2022)
- [Poster] **Sarna, NS**, Hope, JM, Desai, S, & King, MR. “Enhanced T Cell Activation via Fluid Shear Stress”, **The Vanderbilt Center on Mechanobiology Inaugural Retreat, Nashville, TN** (Aug. 2022)
 - 2nd place Poster Presentation
- [Poster] **Sarna, NS**, Hope, JM, Desai, S, & King, MR. “Enhanced T Cell Activation via Fluid Shear Stress”, **NIH National Cancer Institute (NCI) Cancer Tissue Engineering Collaborative (TEC) Annual Meeting, Madison WI** (July 2022)
 - 1st place Poster Presentation
- [Oral] **Sarna, NS**, Marrero-Morales, L, DeGroff, R, Rivera-Rodriguez, A, Lui, S, Good, H, Rinaldi-Ramos, CM. “Advancing the Principles of Replacement, Reduction, and Refinement by Evaluating an Anatomically Correct Mouse Phantom for a Brain Tumor Model in Magnetic Particle Imaging”, **University of Florida Undergraduate Research Symposium, Gainesville, FL** (Apr. 2021)
 - Outstanding Undergraduate Research Award
- [Oral] **Sarna, NS**, Marrero-Morales, L, R, Rivera-Rodriguez, Rinaldi-Ramos, CM. “Evaluating the Sensitivity of the MomentumTM Magnetic Particle Imaging System for Ferucarbotran Iron Oxide Nanoparticles” **American Institute of Chemical Engineers (AIChE) Annual Meeting, Orlando, FL** (Nov. 2019)

PROFESSIONAL DEVELOPMENT CONFERENCES

- [Attendee] NextProf Pathfinder Workshop, *San Diego, CA* (Oct. 2022)
- [Attendee] IEEE Engineering in Medicine and Biology Conference (EMBC), *Orlando, FL* (Aug. 2016)

TEACHING EXPERIENCE

Graduate Student Research Mentor

Jan. 2022-Present
Nashville, TN

Vanderbilt University

- Mentor and train undergraduate student on research techniques in Dr. Michael King’s lab
- Conceptualize undergraduate student research project which aims to treat chemotherapy resistant glioblastoma brain cancer cells through combined treatment regimens
- Design, plan, and oversee experiments performed by undergraduate student

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SyBBURE Searle Undergraduate Research Program

Jan. 2022-Present

Vanderbilt University

Nashville, TN

- SyBBURE Searle Graduate Fellow
 - Lead weekly subgroup meetings with undergraduate students to provide guidance and direction in their research topics
 - Advise and mentor a group of undergraduate students through a semester long, team-based STEM project
 - Organize and teach personal and professional skill workshops for undergraduate students, including Computer Aided Design (CAD), computer programming, circuit board design, CV/resume building, and time and stress management

Biomedical Engineering Lab (BME2900/3900/4901) Teaching Assistant

Jan. 2022-May 2022

Vanderbilt University

Nashville, TN

- Aided sophomore (3 sections), junior (1 section), and senior (1 section) undergraduate BME students with experimental design, data collection in lab, and scientific writing
- Provided detailed feedback, edits, and grades to student drafts and final lab reports

Introduction to Engineering (ES1041) Teaching Assistant

Aug. 2021-Dec. 2021

Vanderbilt University

Nashville, TN

- Assisted freshman undergraduate students with their coursework and final projects that involve BME wearable device design conceptualization and prototyping
- Planned and led lectures on microcontroller programming and Computer Aided Design (CAD) for project prototyping

UNIVERSITY INVOLVEMENT

BME Graduate Student Association (GSA)

Aug. 2021-Present

Vanderbilt University

Nashville, TN

- Co-chair, Elementary Education Outreach (Aug. 2021-Dec. 2021)
- Chair, Elementary Education Outreach (Jan. 2022-Present)

Biomedical Engineering Society

Aug. 2017-May 2021

University of Florida

Gainesville, FL

- Member

Society of Women in Engineering (SWE)

Aug. 2017-May 2021

University of Florida

Gainesville, FL

- Member

Philharmonic Orchestra

Aug. 2017-Dec. 2017

University of Florida

Gainesville, FL

- Violinist

SKILLS

- **Research Techniques:** Cell culture, animal handling/experiments, flow cytometry, light/fluorescence microscopy, liquid biopsy/blood sample processing, magnetic cell separation (T cells/circulating tumor cells), histological staining, rotary microtome, western blot, IVIS SpectrumCT, Magnetic Particle Imaging (MPI), Dynamic Light Scattering (DLS), Dynamic Magnetic Susceptibility (DMS)
- **Data Analysis:** ImageJ, GraphPad Prism, JMP, FlowJo, Excel
- **Programming:** MATLAB, HTML, CSS, Git, Python
- **Computer Aided Design:** Solidworks, OnShape, Autodesk Inventor, Autodesk Fusion