

# GARRETT FARRELL BEEGHLY

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## EDUCATION AND TRAINING

**Cornell University** College of Engineering

PhD in Biomedical Engineering

MS in Biomedical Engineering

**Ithaca, NY**

2018 – Present

2018 – 2021

**University of Cambridge** Medical Research Council

Whitaker Research Fellow

**Cambridge, UK**

2017 – 2018

**University of Virginia** School of Engineering and Applied Science

BS in Biomedical Engineering, GPA: 3.99 of 4.00

**Charlottesville, VA**

2013 – 2017

## AWARDS AND HONORS

**Kirschstein National Research Service Award (F31)** National Cancer Institute

July 2023

**Caroline Coffey Fund Travel Award** Cornell University

December 2022

**Teaching Assistant of the Year** Meinig School of Biomedical Engineering

August 2021

**Center for Teaching Innovation Fellowship** Cornell University

June 2021

**NSF Graduate Research Fellowship** National Science Foundation

May 2019

**Presidential Life Science Fellowship** Cornell University

August 2018

**Fischell Bioengineering Scholarship** Cornell University

August 2018

**Tau Beta Pi Fellowship** Tau Beta Pi National Engineering Honor Society

May 2018

**Whitaker Research Fellowship** Institute of International Education

March 2017

**Harrison Undergraduate Research Award** University of Virginia

March 2016

**Rodman Honors Scholarship** University of Virginia

August 2013

## RESEARCH EXPERIENCE

**Cornell University** Graduate Research Assistant

**Ithaca, NY**

Advisor: Claudia Fischbach, PhD

August 2018 – Present

- Developed protocols to isolate, culture, and analyze populations of primary adipocytes stratified by cell diameter from human or mouse donors.
- Examined how adipocyte hypertrophy influences breast cancer progression and tumor cell behavior independently of body mass index.

**Max Planck Institute for the Science of Light** Visiting Scientist

**Erlangen, DE**

Advisor: Jochen Guck, PhD

June 2023

- Isolated primary adipocytes from lean and obese mice for mechanical analysis.
- Performed Brillouin microscopy and atomic force microscopy to assess adipocyte mechanics as a function of mouse diet and cell diameter.

**New York – Presbyterian Hospital** NIH-T35 Trainee

**New York, NY**

Advisor: Jason Spector, MD

June 2019 – July 2019

- Compared the extracellular matrix composition of human mammary adipose tissue across demographics including age, race, body mass index, and menopause status.
- Established a protocol for decellularizing human mammary adipose tissue to isolate extracellular matrix components for inclusion in tissue-engineered models of breast cancer.

**University of Cambridge** Whitaker Research Fellow

Advisor: Jacqueline Shields, PhD

**Cambridge, UK**

August 2017 – July 2018

- Developed a microfluidic system to model the tumor-draining lymph node.
- Monitored changes in lymph node immune cell composition, localization, and activation status via immunofluorescence, live imaging, and flow cytometry.

**University of Virginia** Undergraduate Research Assistant

Advisor: Jennifer Munson, PhD

**Charlottesville, VA**

March 2015 – May 2017

- Assessed stromal heterogeneity across glioblastoma and breast cancer patient samples via immunohistochemistry and correlated the quantified metrics with clinical outcomes.
- Developed a 3D tissue-engineered model of metastatic breast cancer to investigate how tumor cell behavior is modulated by microenvironmental cues after metastasis to the brain.

## TEACHING EXPERIENCE

**Cornell University** Center for Teaching Innovation Fellow

Advisor: Derina Samuel, PhD

**Ithaca, NY**

Fall 2021 – Spring 2023

- Participated in regular meetings focused on strengthening my teaching abilities including curriculum development, active learning strategies, inclusive assessments, and more.
- Developed and led workshops as well as annual university-wide conferences on these topics for other graduate students and postdocs interested in teaching at Cornell.

**Yale University** Guest Lecturer

Instructor: Corey O'Hern, PhD

**New Haven, CT**

Fall 2021 – Fall 2023

Course: Physical Biology Integrated Workshop (MBB 591)

- Lecture provided first-year graduate students with an overview of cancer classification, pathogenesis, and clinical management with a specific focus on breast cancer.
- Students subsequently used this information to simulate tumor invasion dynamics via discrete element method (DEM) models.

**Cornell University** Graduate Teaching Assistant

Instructors: Shivaun Archer, PhD and Claudia Fischbach, PhD

**Ithaca, NY**

Fall 2020

Course: Laboratory Techniques for Molecular, Cellular, and Systems Engineering (BME 4190)

- Course introduced students to laboratory techniques including cell culture, flow cytometry, stem cell differentiation, RT-qPCR, viral transfection, hydrogel fabrication, transcriptomics, chromogenic and immunofluorescence staining, spheroid culture, and confocal microscopy.
- Responsibilities included updating protocols, preparing reagents, demonstrating lab techniques, holding office hours, grading lab reports, writing and grading exams.

**University of Virginia** Undergraduate Teaching Assistant

Instructor: Timothy Allen, PhD

**Charlottesville, VA**

Summer 2016

Course: Integrative Design and Experimental Analysis Lab (BME 3080)

- Course introduced students to common biomedical laboratory techniques including cell culture, immunofluorescence, Western blotting, and RT-qPCR.
- Responsibilities included preparing reagents for lab, leading and instructing students, demonstrating proper lab technique, holding office hours, and grading exams.

## PUBLICATIONS

**GF Beeghly**, JC Crowley, J Deng, MI Pincus, DJ Falcone, NM Iyengar, C Fischbach. (2024). Membrane tension facilitates vesicle-mediated lipid release by hypertrophic adipocytes to reprogram tumor cell metabolism and promote cancer progression. *In preparation*.

**GF Beeghly**, J Deng, C Fischbach. (2024). Protocol to fabricate elastomer microwells for three-dimensional culture of primary adipocytes. *In press at STAR Protocols*.

Y Zheng, D Wang, **GF Beeghly**, C Fischbach, MD Shattuck, CS O'Hern. (2024). Computational modeling of the physical features that influence breast cancer invasion into adipose tissue. *APL Bioengineering*. [DOI](#).

**GF Beeghly**,\* AA Shimpi,\* RN Riter, C Fischbach. (2023). Measuring and modelling tumour heterogeneity across scales. *Nature Reviews Bioengineering*. [DOI](#). \*Denotes equal contribution

RC Cornelison,\* JX Yuan,\* KM Tate, A Petrosky, **GF Beeghly**, M Bloomfield, SC Schwager, AL Berr, D Cimini, FF Bafakih, JW Mandell, BW Purow, BJ Horton, JM Munson. (2022). A patient-designed tissue-engineered model of the infiltrative glioblastoma microenvironment. *npj Precision Oncology*. [DOI](#). \*Denotes equal contribution

**GF Beeghly**,\* K Amofa,\* C Fischbach, S Kumar. (2022). Regulation of tumor invasion by the physical microenvironment: Lessons from breast and brain cancer. *Annual Review of Biomedical Engineering*. [DOI](#). \*Denotes equal contribution

**GF Beeghly**, CF Thomas, JX Yuan, AR Harris, JM Munson. (2022). Designing patient-driven, tissue-engineered models of primary and metastatic breast cancer. *Bioengineering*. [DOI](#).

L Ling, JA Mulligan, Y Ouyang, AA Shimpi, RM Williams, **GF Beeghly**, BD Hopkins, JA Spector, SG Adie, C Fischbach. (2020). Obesity-associated adipose stromal cells promote breast cancer invasion through direct cell contact and matrix remodeling. *Advanced Functional Materials*. [DOI](#).

DK Logsdon, **GF Beeghly**, JM Munson. (2017). Chemoprotection across the tumor border: Cancer cell response to doxorubicin depends on stromal fibroblast ratios and interstitial therapeutic transport. *Cellular and Molecular Bioengineering*. [DOI](#).

## CONFERENCE PRESENTATIONS

### **External Presentations**

**GF Beeghly**, D Wang, Y Zheng, NM Iyengar, CS O'Hern, C Fischbach. The role of hypertrophic adipocytes in obesity-associated breast cancer progression. *Biomedical Engineering Society Annual Meeting, Seattle, Washington, October 2023. Podium*.

MI Pincus, **GF Beeghly**, C Fischbach. Examining cortical actin remodeling in adipogenesis and adipocyte hypertrophy. *Biomedical Engineering Society Annual Meeting, Seattle, Washington, October 2023. Poster*.

**GF Beeghly**, D Wang, Y Zheng, JD Treado, J Druso, NM Iyengar, CS O'Hern, C Fischbach. Biophysical contributions of adipose tissue to breast cancer invasion. *Gordon Research Conference on the Physical Science of Cancer, Galveston, Texas, February 2023. Poster*.

**GF Beeghly**, AA Shimpi, C Fischbach. Biophysical contributions of adipose tissue to breast cancer invasion. *13<sup>th</sup> Annual Physics of Cancer Symposium, Leipzig, Germany, September 2022. Podium.*

D Wang, JD Treado, **GF Beeghly**, F Arceri, M Murrell, C Fischbach, M Shattuck, CS O'Hern. Mechanical properties of adipose tissue mediate breast cancer invasion. *American Physical Society Meeting, Chicago, Illinois, March 2022. Podium.*

SL Esparza, **GF Beeghly**, JM Munson, SS Verbridge. Agent-based model of spatial fibroblast chemoprotection in the breast cancer microenvironment. *Biomedical Engineering Society Annual Meeting, Orlando, Florida, October 2021. Poster.*

**GF Beeghly**, BR Seo, JD Treado, D Wang, BD Hopkins, B Cho, AJ Dannenberg, NM Iyengar, JA Spector, CS O'Hern, C Fischbach. Engineered platforms to interrogate and model the impact of adipose tissue biophysical parameters on obesity-associated breast cancer. *National Cancer Institute Physical Sciences Oncology Network Annual Investigators Meeting, August 2021. Poster.*

**GF Beeghly**, H Munir, M Gerigk, YYS Huang, JD Shields. Engineering model systems to examine tumor-mediated immune dysfunction. *Gordon Research Conference on the Physical Science of Cancer, Galveston, Texas, February 2019. Poster.*

RC Cornelison, JX Yuan, **GF Beeghly**, KM Tate, JM Munson. The impact of interstitial fluid flow on cell motility and the tumor microenvironment. *Gordon Research Conference on the Physical Science of Cancer, Galveston, Texas, February 2019. Poster.*

**GF Beeghly**, H Munir, M Gerigk, YYS Huang, JD Shields. Engineering a microfluidic system to examine tumor-draining lymph node transformation. *Biomedical Engineering Society Annual Meeting, Atlanta, Georgia, October 2018. Poster.*

**GF Beeghly\***, DN Tavakol.\* Understanding the role of international research experiences on developing integrative and collaborative practices in science. *Biomedical Engineering Society Annual Meeting, Atlanta, Georgia, October 2018. Poster.* \*Denotes equal contribution

**GF Beeghly**, CF Thomas, JX Yuan, AR Harris, JM Munson. Engineering patient-driven models to examine breast cancer behavior after metastasis to the brain. *Biomedical Engineering Society Annual Meeting, Phoenix, Arizona, October 2017. Poster.*

### **Internal Presentations**

**GF Beeghly**, JA Spector, NM Iyengar, C Fischbach. Combining engineered systems and patient-derived samples to model the tumor microenvironment. *Meinig School of Biomedical Engineering Annual Research Symposium, Ithaca, New York, August 2023. Podium.*

**GF Beeghly**, BR Seo, JD Treado, D Wang, BD Hopkins, JA Spector, B Cho, AJ Dannenberg, NM Iyengar, CS O'Hern, C Fischbach. Hypertrophic adipocytes as mediators of breast cancer progression. *Cornell Intercampus Cancer Research Symposium, Ithaca, New York, May 2022. Poster.*

**GF Beeghly**, BR Seo, JD Treado, D Wang, BD Hopkins, JA Spector, B Cho, AJ Dannenberg, NM Iyengar, CS O'Hern, C Fischbach. Hypertrophic adipocytes as mediators of breast cancer progression. *Cornell Annual Stem Cell Retreat, Ithaca, New York, May 2022. Poster.*

**GF Beeghly**, H Munir, M Gerigk, YYS Huang, JD Shields. Designing a microfluidic platform to monitor immune reprogramming in tumor-draining lymph nodes. *Whitaker International Program Annual Meeting, Budapest, Hungary, April 2018. Podium.*

**GF Beeghly**, H Munir, M Gerigk, YYS Huang, JD Shields. Microfluidic approaches to modeling lymphatic-mediated interactions in the tumor-immune microenvironment. *Medical Research Council Annual Retreat, Cambridge, United Kingdom, October 2017. Poster.*

**GF Beeghly**, CF Thomas, JX Yuan, AR Harris, JM Munson. Quantitative analysis of the cellular microenvironment of metastatic breast cancer patient resections. *University of Virginia Undergraduate Research Symposium, Charlottesville, Virginia, April 2017. Poster.*

## INVITED TALKS

**GF Beeghly**. Let's put cancer in context. What is the tumor microenvironment? Cancer Research Education Day for Patients and Survivors. *Cornell Community Cancer Partnership, Ithaca, New York, October 2022. Invited speaker.*

**GF Beeghly**. Pursuing interdisciplinary cancer research in graduate school. *Cancer Systems Biology Consortium and Physical Sciences Oncology Network Summer Undergraduate Research Program, National Cancer Institute, July 2021. Invited panelist.*

**GF Beeghly**. Primer for the Distinguished Lecture in Cancer Biology given by Dr. Mina J. Bissell. Why don't we get more cancer? The critical role of extracellular matrix and microenvironment in malignancy and dormancy. Life Sciences Lecture Series. *Cornell College of Veterinary Medicine, Ithaca, New York, November 2019. Invited speaker.*

**GF Beeghly**, JA Aird, Y Wang. How to write a successful application for the National Science Foundation Graduate Research Fellowship Program. *Cornell Graduate School, Ithaca, New York, September 2019. Invited panelist.*

**GF Beeghly**. Let's put cancer in context. What is the tumor microenvironment? Cancer Research Education Day for Patients and Survivors. *Cornell Community Cancer Partnership, Ithaca, New York, September 2019. Invited speaker.*

## LEADERSHIP, MENTORSHIP, AND OUTREACH

Reviewer for *Science Advances* (AAAS), *Nature Methods* (Springer Nature), *Cell Reports* (Cell Press), *NPJ Breast Cancer* (Springer Nature), and *Advanced Biology* (Wiley).

### **Cornell Community Cancer Partnership**

**Ithaca, NY**

Cancer Resource Center of the Finger Lakes

Fall 2018 – Present

- Delivered the first presentation for the inaugural Cancer Research Education Day which included over 40 cancer patients and survivors from upstate New York.
- Participated in seminars between cancer patients, survivors, and researchers designed to promote dialogue between these communities.

### **Mentor for Undergraduate Research**

**Ithaca, NY**

Meinig School of Biomedical Engineering, Cornell University

Fall 2021 – Spring 2024

- Mentored Marlee Pincus, an undergraduate student in Biological and Environmental Engineering, who pursued independent research projects to complement my own experiments.

- Under my mentorship, Marlee received a Cornell Engineering Learning Initiatives Grant and presented her findings at the 2023 Biomedical Engineering Society Annual Meeting.

### **Special Session on Engineering and Physical Sciences in Oncology**

**Seattle, WA**

Biomedical Engineering Society Annual Meeting

October 2023

- Co-chaired and organized a special session on Integrating Engineering and Physical Sciences in Oncology at the 2023 Biomedical Engineering Society Annual Meeting.
- Coordinated a panel of three keynote faculty speakers and solicited, reviewed, and selected applications for an additional five trainee speakers.

### **Diversity, Equity, and Inclusion Committee**

**Ithaca, NY**

Meinig School of Biomedical Engineering, Cornell University

Fall 2021 – Spring 2023

- Met with prospective faculty candidates to discuss topics pertaining to diversity, equity, and inclusion and provided feedback about candidates to the hiring committee.
- Helped develop and coordinate a seminar series to highlight diversity within our own department and to invite external speakers to discuss issues related to equity and inclusion.

### **Ivy Plus Teaching Transformations Graduate Summit**

**New York, NY**

Center for Teaching and Learning, Columbia University

Spring 2023

- Participated in a multi-university summit to discuss transformative teaching practices as a representative of the Cornell University Center for Teaching Innovation.

### **AIMBE Public Policy Institute for Rising Leaders**

**Washington, DC**

American Institute for Medical and Biological Engineering

Fall 2019

- Participated in a multi-day institute focused on how public policies influence biomedical research and the role scientists have as stakeholders in shaping legislation.

### **Girl Scout Engineering Days**

**Ithaca, NY**

Cornell Graduate Chapter of the Biomedical Engineering Society

Spring 2019 – Fall 2019

- Developed and led hands-on learning activities about imaging modalities in medicine for over 100 visiting Girls Scouts to promote enthusiasm about science and engineering.

### **Graduate Student Outreach Program**

**Enfield, NY**

Cornell University Public Service Center

Spring 2019

- Developed and taught four classes about human health and medicine in collaboration with a local teacher at Enfield Elementary School.

## **SKILLS AND KNOWLEDGE**

### ***Laboratory techniques***

Aseptic cell culture, 3D cell culture, spheroid culture, primary cell isolation, mouse handling and care, rheology, natural biomaterials, atomic force microscopy (AFM), confocal microscopy, fluorescence lifetime imaging microscopy (FLIM), immunofluorescence, immunohistochemistry, flow cytometry, fluorescence-activated cell sorting (FACS), magnetic-activated cell sorting (MACS), ELISA, RNA isolation, RT-qPCR, bulk transcriptomics, Western blotting, extracellular vesicle purification, microfluidics, Seahorse metabolic flux assays.

### ***Languages and software***

R, Bash, HTML, Java, MATLAB, ImageJ, FlowJo, GraphPad Prism, Adobe Illustrator.