

Marjan Rafat, PhD

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Education

Harvard University

Cambridge, MA

- PhD in Engineering Sciences May 2012
- Concentration: Biomedical Engineering
- Dissertation Title: "Dual Antibody Functionalized Polyvinyl Alcohol and Alginate Hydrogels for Synergistic Endothelial Cell Adhesion"

Massachusetts Institute of Technology (MIT)

Cambridge, MA

- SB in Chemical Engineering Jun. 2006
- Minors in Biomedical Engineering and Chemistry

Employment

Vanderbilt University

Nashville, TN

Assistant Professor, Department of Chemical and Biomolecular Engineering Jan. 2018-Present

Assistant Professor, Department of Biomedical Engineering (Secondary)

Assistant Professor, Department of Radiation Oncology (Secondary)

Faculty Member, Program in Cancer Biology

Faculty Member, Breast Cancer Research Program, Vanderbilt-Ingram Cancer Center

Jun. 2019-Present

Faculty Member, Vanderbilt Program for Extracellular Vesicle Research

Dec. 2019-Present

Faculty Member, Vanderbilt Institute for Infection, Immunology & Inflammation (VI4)

July 2020-Present

Stanford University

Stanford, CA

Postdoctoral Scholar, Department of Radiation Oncology Sep. 2012-Dec. 2017

Research Experience

Stanford Imaging Radiobiology Laboratory

Stanford, CA

Postdoctoral Scholar Sep. 2012-Dec. 2017

Advisor: Prof. Edward Graves

- Determined the relationship between cancer therapies and circulating tumor cell recruitment
- Evaluated the effects of radiation and surgery on tumor and immune cell migration in a preclinical breast cancer model
- Analyzed the role of the tumor microenvironment in cancer recurrence
- Examined the normal tissue sparing effect of ultra-high dose rate irradiation

Harvard Biomaterials Laboratory

Cambridge, MA

Graduate Research Scientist Sep. 2006-May 2012

Advisor: Prof. Debra Auguste

- Studied the relationship between geometry, flow patterns, and endothelial cell gene expression in cerebral aneurysms
- Synthesized bioadhesive polyvinyl alcohol and alginate hydrogels that exhibit *in situ* crosslinking for aneurysm treatment
- Improved cardiomyocyte function using conductive hydrogel scaffolds
- Assembled pH-sensitive colloids into morphing microstructures

MIT Biomaterials Science and Engineering Lab

Cambridge, MA

Student Research Associate Jan. 2003-Aug. 2006

Advisor: Prof. ChoKyun Rha

- Characterized the physiochemical properties of asiatic and madecassic acid
- Proved an existing critical micelle concentration, which had never been reported in the literature

Research Funding

R00 CA201304 NIH NCI	Rafat (PI)	04/01/18 - 03/31/22
Deconstructing the Tumor Microenvironment and its Contribution to Metastasis		
The goal of this project is to determine the microenvironmental factors responsible for local recurrence following therapy in breast cancer.		
Role: PI		
VINSE Pilot Award Vanderbilt University	Rafat (PI)	10/10/19-12/31/20
Using Atomic Force Microscopy to Determine Changes in Tissue Stiffness following Radiation Damage		
The goal of this project is to quantify the mechanical properties of the mammary fat pad following irradiation under immunocompetent and immunocompromised conditions.		
Role: PI		
Young Investigator Grant Breast Cancer Alliance, Inc.	Rafat (PI)	02/01/20-07/31/22
Novel Mammary Organoids to Examine Radiation-Induced Recurrence in HER2BC		
The goal of this project is to evaluate the effect of radiation on tumor and immune cell recruitment in breast cancer through 3D mammary organoids.		
Role: PI		
Conquer Cancer Now Award Concern Foundation	Rafat (PI)	10/08/20-03/31/23
Radiation-Induced Pre-Metastatic Niche Formation in Breast Cancer Recurrence		
The goal of this project is to characterize how normal tissue radiation damage promotes pre-metastatic niche formation and recurrence in breast cancer.		
Role: PI		
Research Scholar Grant American Cancer Society	Rafat (PI)	01/01/2022-12/31/25
Examining Obesity-Associated Inflammation in Breast Cancer Recurrence		
The goal of this project is to determine the role of radiation damage and inflammation on breast cancer recurrence in obese patients.		
Role: PI		
Early Career Investigator Award METAvivor	Rafat (PI)	02/01/2022-01/31/24
An Engineered Bone Marrow Microenvironment Model to Investigate the Impact of Stiffness in Breast Cancer Metastasis		
The goal of this project is to engineer a biomimetic model of the bone marrow to determine the role of stiffness on breast cancer metastatic progression.		
Role: PI		
VINSE Pilot Award Vanderbilt University	Rafat (PI)	03/04/22-06/30/22
Fabricating a microfluidic device to elucidate interactions of circulating tumor and immune cells with irradiated vasculature		

The goal of this project is to design a microfluidic device that allows for the co-culture of endothelial cells and neutrophils to study the impact of the irradiated vasculature on breast cancer recurrence.

Role: PI

Cancer Immunotherapy Award

Caskey (PI)

04/01/23-03/31/24

Focused Ultrasound Foundation

Biomechanical modulation of inflammation with FUS for breast cancer therapy

The goal of this project is to assess the ability of pulsed FUS to promote a microenvironment that prevents tumor recurrence following radiation therapy.

Role: Co-I

Honors and Awards

NCI Early Investigator Advancement Program	2022
Meharry-Vanderbilt-TSU Cancer Partnership (MVTCP) Program Honorarium	2019, 2020
NIH Pathway to Independence Award	2016
AACR Women in Cancer Research Scholar Award	2016
Katherine McCormick Advanced Postdoctoral Fellowship	2015-2016
Women in Molecular Imaging Scholar Award	2015
Best Poster Award, 7 th Annual Center for Biomedical Imaging at Stanford Symposium	2015
The Helena Anna Henzl-Gabor Young Women in Science Fund for Postdoctoral Scholars Travel Grant	2015
Selected as "Highlight Speaker" at the World Molecular Imaging Congress Annual Meeting	2015
NIH NRSA Postdoctoral Fellowship in the Radiation Sciences (T32)	2012-2013; 2015-2016
American Heart Association Founders Affiliate Predoctoral Fellowship	2009-2011
Honorable Mention, National Science Foundation Graduate Research Fellowship	2007
Certificate of Distinction in Teaching, Harvard University	2007, 2009

Publications

PEER-REVIEWED RESEARCH ARTICLES

1. Wen X, Ou L, Cutshaw G, Uthaman S, Ou YC, Zhu T, Szakas S, Carney B, Houghton J, Gundlack-Graham A, **Rafat M**, Yang K, Bardhan R. Physicochemical Properties and Route of Systemic Delivery Control the In Vivo Dynamics and Breakdown of Radiolabeled Gold Nanostars. *Small*. 2023; e2204293.
2. **Rafat M***, El Kaffas A*, Swarnakar A, Shostak A, Graves EE. Non-Invasive monitoring of normal tissue radiation using quantitative ultrasound spectroscopy. *Medical Physics*. 2023; 50(20): 1251-1256. *Equal contribution. *Cover Story*.
3. Moon EJ, Mello SS, Li C, Chi JT, Thakkar K, LaGory E, Diep A, Miao Y, **Rafat M**, Lee IJ, Vilalta M, Castellini L, Krieg A, Graves EE, Attardi LD, Giaccia AJ. The HIF Target MAFF Promotes Tumor Invasion and Metastasis through IL11 and STAT3 Signaling. *Nature Communications*. 2021; 12(1): 4308.
4. Todd V, Vecchi L, Clements M, Snow K, Ontko C, Himmel L, Pinelli C, **Rafat M**, Johnson RW. Hypoxia Inducible Factor Signaling in Breast Tumors Controls Spontaneous Tumor Dissemination in a Site-Specific Manner. *Communications Biology*. 2021; 4(1): 1122.
5. Tailor D, Resendez A, Garcia-Marques FJ, Pandrala M, Going CC, Bermudez A, Kumar V, **Rafat M**, Nambiar DK, Honkala A, Le QT, Sledge GW, Graves EE, Pitteri SJ, Malhotra SV. Y box binding protein 1 inhibition as a targeted therapy for ovarian cancer. *Cell Chemical Biology*. 2021; 28(8): 1206-1220.e6.
6. Kim YEK, Gwak SH, Hong BH, Oh JM, Choi HS, Kim MS, Oh S, Lartey FM, **Rafat M**, Schüler E, Kim HS, von Eyben R, Weissman IL, Koch CJ, Maxim PG, Loo BW Jr, Ahn GO. Effects of ultra-high dose rate FLASH irradiation on the tumor microenvironment in Lewis lung carcinoma: role of myosin light chain. *International Journal of Radiation Oncology, Biology, Physics*. 2021; 109(5): 1440-1453.

7. Levy K, Natarajan S, Wang J, Chow S, Eggold JT, Loo P, Manjappa R, Melemenidis S, Lartey FM, Schüler E, Skinner L, **Rafat M**, Ko R, Kim A, Al Rawi D, von Eyben R, Dorigo O, Casey KM, Graves EE, Bush K, Yu AS, Koong AC, Maxim PG, Loo BW Jr, Rankin EB. Abdominal FLASH irradiation reduced radiation-induced gastrointestinal toxicity for the treatment of ovarian cancer in mice. *Scientific Reports*. 2020; 10(1): 21600.
8. Aguilera TA, Elghonaimy E, Shehade H, **Rafat M**, Castellini L, Jiang D, Kariolis M, Koong AC, Le QT, Ellies LG, Rankin EB, Graves EE, Giaccia AJ. Induced tumor heterogeneity reveals factors informing radiation and immunotherapy combinations. *Clinical Cancer Research*. 2020; 26(12): 2972-2985.
9. Sherry AD, von Eyben R, Newman NB, Gutkin P, Mayer I, Horst KC, Chakravarthy AB, **Rafat M**. Systemic Inflammation after Radiation Predicts Locoregional Recurrence, Progression, and Mortality in Stage II-III Triple-Negative Breast Cancer. *International Journal of Radiation Oncology, Biology, Physics*. 2020; 108(1): 268-276.
10. Wang-Bishop L, Wehbe M, Shae D, James JL, Hacker BC, Garland KM, Christov P, **Rafat M**, Balko JM, Wilson JT. Potent STING Activation Stimulates Immunogenic Cell Death to Enhance Antitumor Immunity in Neuroblastoma. *Journal for ImmunoTherapy of Cancer*. 2020; 8(1): e000282.
11. Carozza JA, Böhnert V, Shaw KE, Nguyen KC, Skariah G, Brown JA, **Rafat M**, von Eyben R, Graves EE, Glenn JS, Smith M, Li L. Extracellular cGAMP is a cancer cell-produced immunotransmitter involved in radiation-induced anti-cancer immunity. *Nature Cancer*. 2020; 1: 184-196.
12. Ou YC, Wen X, Johnson CA, Shae D, Ayala OD, Webb JA, Lin EC, DeLapp RC, Boyd KL, Richmond A, Mahadevan-Jansen A, **Rafat M**, Wilson JT, Balko JM, Tantawy MN, Vilgelm AE, Bardhan R. Multimodal Multiplexed Immunoimaging with Nanostars to Detect Multiple Immunomarkers and Monitor Response to Immunotherapies. *ACS Nano*. 2020; 14(1): 651-663.
13. Gholamin S, Youssef OA, **Rafat M**, Esparza R, Kahn S, Shahin M, Giaccia AJ, Graves EE, Weissman I, Mitra S, Cheshier SH. Irradiation or Temozolomide Chemotherapy Enhances Anti-CD47 Treatment of Glioblastoma. *Innate Immunity*. 2020; 26(2): 130-137.
14. Simmons DA, Lartey FM, Schüler E, **Rafat M**, King G, Kim A, Ko R, Semaan S, Gonzalez S, Jenkins MJ, Pradhan P, Shih Z, Wang J, von Eyben R, Graves EE, Maxim PG, Longo FM, Loo BW Jr. Reduced Cognitive Deficits after FLASH Irradiation of Whole Mouse Brain Are Associated with Less Hippocampal Dendritic Spine Loss and Neuroinflammation. *Radiotherapy and Oncology*. 2019; 139: 4-10.
15. Alves SM, Zhu T, Shostak A, Rossen NS, **Rafat M**. Studying Normal Tissue Radiation Effects using Extracellular Matrix Hydrogels. *Journal of Visual Experiments*. 2019; 149: e59304.
16. Hacker BC, Gomez JD, Silvera Batista CA, **Rafat M**. Growth and Characterization of Irradiated Organoids from Mammary Glands. *Journal of Visual Experiments*. 2019; 147: e59293.
17. Wisdom KM, Adebowale K, Chang J, Lee JY, Nam S, Desai R, Rossen NS, **Rafat M**, Hodgson L, Chaudhuri O. Matrix Mechanical Plasticity Regulates Cancer Cell Migration through Confining Microenvironments. *Nature Communications*. 2018; 9(1): 4144.
18. **Rafat M**, Aguilera TA, Vilalta M, Bronsart LL, Soto LA, von Eyben R, Golla MA, Ahrari Y, Melemenidis S, Afghahi A, Jenkins MJ, Kurian AW, Horst KC, Giaccia AJ, Graves EE. Macrophages Promote Circulating Tumor Cell-Mediated Local Recurrence Following Radiation Therapy in Immunosuppressed Patients. *Cancer Research*. 2018; 78(15): 4241-4252.
19. Vilalta M, Brune JE, **Rafat M**, Soto LA, Graves EE. The Role of Granulocyte Macrophage Colony Stimulating Factor (GM-CSF) in Radiation-Induced Tumor Cell Migration. *Clinical and Experimental Metastasis*. 2018; 35(4): 247-254.
20. **Rafat M***, Dabagh M*, Heller M, Rabinov J, Stone HA, Randles A, Auguste DT. Impact of Diversity of Morphological Characteristics and Reynolds number on Local Hemodynamics in Basilar Aneurysms. *AIChE Journal*. 2018; 64(7): 2792-2802. *Equal contribution.

21. Lartey FM*, **Rafat M***, Negahdar M, Malkovskiy AV, Dong X, Sun X, Li M, Doyle T, Rajadas J, Graves EE, Loo BW Jr, Maxim PG. Dynamic CT Imaging of Volumetric Changes in Pulmonary Nodules Correlates with Physical Measurements of Stiffness. *Radiotherapy and Oncology*. 2017; 122(2): 313-318. *Equal contribution.
22. Schüler E, Trovati S, King G, Lartey FM, **Rafat M**, Villegas M, Praxel AJ, Loo BW Jr, Maxim PG. Experimental Platform for Ultra-high Dose Rate FLASH Irradiation of Small Animals using a Clinical Linear Accelerator. *International Journal of Radiation Oncology, Biology, Physics*. 2017; 97(1): 195-203.
23. Aguilera TA, **Rafat M**, Castellini L, Shehade H, Kariolis MS, Hui A, Stehr H, von Eyben R, Jiang D, Ellies LG, Koong AC, Diehn M, Rankin EB, Graves EE, Giaccia AJ. Reprogramming the Immunological Microenvironment Through Radiation and Targeting Axl. *Nature Communications*. 2016; 7: 13898.
24. You JO*, **Rafat M***, Almeda D, Maldonado N, Guo P, Nabzdyk CS, Chun M, LoGerfo FW, Hutchinson JW, Pradhan-Nabzdyk LK, Auguste DT. pH-Responsive Scaffolds Generate a Pro-Healing Response. *Biomaterials*. 2015; 57: 22-32. *Equal contribution. *Highlighted in Materials Today*. May 21, 2015.
25. Vilalta M, **Rafat M**, Giaccia AJ, Graves EE. Recruitment of Circulating Breast Cancer Cells Is Stimulated by Radiotherapy. *Cell Reports*. 2014; 8(2): 402-409.
26. Lartey FM, Ahn GO, Ali R, Rosenblum S, Miao Z, Arksey N, Shen B, Vilalta M, **Rafat M**, Liu H, Alejandro-Alcazar MA, Chen JW, Palmer T, Chin FT, Guzman R, Loo BW Jr, Graves EE. The Relationship Between Serial [(18)F]PBR06 PET Imaging of Microglial Activation and Motor Function Following Stroke in Mice. *Molecular Imaging & Biology*. 2014; 16(6): 821-829.
27. **Rafat M**, Rotenstein L, Hu J, Auguste DT. Engineered Endothelial Cell Adhesion via VCAM1 and E-selectin Antibody-Presenting Alginate Hydrogels. *Acta Biomaterialia*. 2012; 8(7): 2697-2703.
28. **Rafat M**, Rotenstein L, You JO, Auguste DT. Dual Functionalized PVA Hydrogels that Adhere Endothelial Cells Synergistically. *Biomaterials*. 2012; 33(15): 3880-3886.
29. You JO, **Rafat M**, Auguste DT. Cross-Linked, Heterogeneous Colloidosomes Exhibit pH-Induced Morphogenesis. *Langmuir*. 2011; 27(18): 11282-11286.
30. You JO, **Rafat M**, Ye GJC, Auguste DT. Nanoengineering the Heart: Conductive Scaffolds Enhance Connexin 43 Expression. *Nano Letters*. 2011; 11(9): 3643-3648. *Highlighted in Nature Nanotechnology*. 2011; 6(11): 692-693.
31. **Rafat M**, Raad DR, Rowat AC, Auguste DT. Fabrication of Reversibly Adhesive Fluidic Devices using Magnetism. *Lab on a Chip*. 2009; 9(20): 3016-3019.
32. **Rafat M**, Fong KW, Goldsipe A, Stephenson BC, Coradetti ST, Sambandan TG, Sinskey AJ, Rha CK. Association (Micellization) and Partitioning Aglycon Triterpenoids. *Journal of Colloid and Interface Science*. 2008; 325(2): 324-330.

PREPRINTS

1. Zhu T, Alves SM, Adamo A, Wen X, Corn KC, Shostak A, Shaub ND, Hacker BC, D'Amore A, Bardhan R, **Rafat M**. Mammary Tissue-Derived Extracellular Matrix Hydrogels Reveal the Role of the Irradiated Microenvironment in Breast Cancer Recurrence. *BioRxiv* [preprint]. May 16, 2022. Available from: <https://doi.org/10.1101/2022.05.16.492117>.
2. Corn KC, Britto LS, Ivanova YI, Mohamed Y, **Rafat M**. Radiation-Induced Metabolic Reprogramming of Fibroblasts Regulates the Breast Cancer Microenvironment. *BioRxiv* [preprint]. May 18, 2022. Available from: <https://doi.org/10.1101/2022.05.17.492249>.
3. Hacker BC, Herman DC, Lin EJ, Questell AM, Hedges RJ, **Rafat M**[#]. Irradiated Mammary Spheroids Elucidate Mechanisms of Macrophage-Mediated Breast Cancer Recurrence. *BioRxiv* [preprint]. July 24, 2022. Available from: <https://doi.org/10.1101/2022.07.24.501296>.

REVIEWS/ RESEARCH HIGHLIGHTS

1. Berumen Sánchez G, Bunn KE, Pua HH, **Rafat M**. Extracellular Vesicles: Mediators of Intercellular Communication in Tissue Injury and Disease. *Cell Communication and Signaling*. 2021; 19(1): 104.
2. Hacker BC and **Rafat M**. Organoids as Complex *In Vitro* Models for Studying Radiation-Induced Cell Recruitment. *Cellular and Molecular Bioengineering*. 2020; 13(4): 341-357.
3. Corn KC, Windham MA, **Rafat M**. Lipids in the tumor microenvironment: From cancer progression to treatment. *Progress in Lipid Research*. 2020; 80: 101055.
4. Northcutt LA*, Suarez-Arnedo A*, **Rafat M**. Emerging Biomimetic Materials for Studying Tumor and Immune Cell Behavior. *Annals of Biomedical Engineering*. 2020; 48(7): 204-2077. *Equal Contribution.
5. Zanganeh S, Georgala P, Corbo C, Arabi L, Ho JQ, Javdani N, Sepand MR, Cruickshank K, Campesato LF, Weng CH, Hemayat S, Andreou C, Alvim R, Hutter G, **Rafat M**, Mahmoudi M. Immunoengineering in Glioblastoma Imaging and Therapy. *Wiley Interdisciplinary Reviews: Nanomedicine and Nanobiotechnology*. 2019; 11(6): e1575.
6. Vilalta M, **Rafat M**, Graves EE. Effects of Radiation on Metastasis and Tumor Cell Migration. *Cellular and Molecular Life Sciences*. 2016; 73 (16): 2999-3007.
7. **Rafat M**, Ali R, Graves EE. Imaging Radiation Response in Tumor and Normal Tissue. *American Journal of Nuclear Medicine and Molecular Imaging*. 2015; 5(4): 317-332.
8. **Rafat M**. Enzymatically crosslinked microporous hydrogel scaffolds that form *in situ* promote dermal healing. *Regenerative Medicine*. 2015; 10(4): 391-392.
9. **Rafat M**. Real-time Evaluation of Cell Viability using Nanoprobes. *Regenerative Medicine*. 2015; 10(4): 391-392.
10. **Rafat M**. Harnessing the immune response for successful scaffold vascularization. *Regenerative Medicine*. 2015; 10(1): 15-16.
11. **Rafat M**. Triggering the switch from benign to malignant phenotypes *in vitro* through independent modulation of extracellular matrix stiffness and composition. *Regenerative Medicine*. 2014; 9(6): 721-722.

BOOK CHAPTERS

1. Satterstrom FK, **Rafat M**, You JO and Auguste DT. Emerging Technologies in Nanomedicine. Chapter 11. *Nanobiomaterials Handbook*. 2011. CRC press/Taylor Francis group. Edited by Balaji Sitharaman.
2. Ho JQ, Arabi L, Basu M, Khaled F, Gonzalez Y, Ghegeliu D, Javdani N, Aieneravaie M, Georgala P, Sepand MR, **Rafat M**, Zanganeh S. Nanotechnology and Nanomedicine. Chapter 2. *Nanomedicine for Ischemic Cardiomyopathy*. 2020. Academic Press. Edited by Morteza Mahmoudi.
3. Aieneravaie M, Ho JQ, Arabi L, Lee J, Herrera K, Mehreen S, Javdani N, Georgala P, Sepand MR, **Rafat M**, Zanganeh S. Use of Nanoparticulate Systems to Salvage the Myocardium. Chapter 7. *Nanomedicine for Ischemic Cardiomyopathy*. 2020. Academic Press. Edited by Morteza Mahmoudi.
4. Javdani N, Ho JQ, Arabi L, Le A, Ghegeliu D, Aieneravaie M, Georgala P, Sepand MR, **Rafat M**, Zanganeh S. Nanoparticulate Systems for Monitoring of Therapeutic Cells. Chapter 8. *Nanomedicine for Ischemic Cardiomyopathy*. 2020. Academic Press. Edited by Morteza Mahmoudi.
5. Aieneravaie M, Ho JQ, Arabi L, Kim A, Liang S, Jones S, Javdani N, Georgala P, Sepand MR, **Rafat M**, Zanganeh S. Cell-Nanoparticle Interactions. Chapter 9. *Nanomedicine for Ischemic Cardiomyopathy*. 2020. Academic Press. Edited by Morteza Mahmoudi.
6. Arabi L, Ho JQ, Javdani N, Sharaf M, Lam M, Aieneravaie M, Georgala P, Sepand MR, **Rafat M**, Zanganeh S. Nanoparticulate Systems for Delivery of Biomolecules and Cells to the Injured Myocardium. Chapter 10. *Nanomedicine for Ischemic Cardiomyopathy*. 2020. Academic Press. Edited by Morteza Mahmoudi.

7. Arabi L, Ho JQ, Javdani N, Jones S, Chen I, Sharaf M, Aieneravaie M, Georgala P, Sepand MR, **Rafat M**, Zanganeh S. Nanoparticulate Systems for Sustained Delivery of Paracrine Factors. Chapter 11. *Nanomedicine for Ischemic Cardiomyopathy*. 2020. Academic Press. Edited by Morteza Mahmoudi.

Full publication list (Google Scholar): <https://scholar.google.com/citations?user=b4Nq2jgAAAAJ&hl=en>

Full publication list (Pubmed):

<http://www.ncbi.nlm.nih.gov/sites/myncbi/marjan.rafat.1/bibliography/42669925/public>

Presentations

INVITED TALKS

1. **Rafat M**. Studying Macrophage-Mediated Breast Cancer Recurrence after Radiotherapy. Massachusetts General Hospital Division of Radiation Biophysics Seminar Series; 11/2022.
2. **Rafat M**. Investigating the Role of Normal Tissue Damage in Breast Cancer Recurrence. University of Nevada, Reno Chemical and Materials Engineering Seminar Series; 4/2022.
3. **Rafat M**. Radiation-Induced Normal Tissue Damage in Breast Cancer Recurrence. University of Arkansas Chemical Engineering Seminar Series; 12/2021.
4. **Rafat M**. Abdominal FLASH irradiation reduces radiation-induced gastrointestinal toxicity for the treatment of ovarian cancer in mice. Vanderbilt Ovarian Cancer Alliance (VOCAL) Meeting; 5/2021.
5. **Rafat M**. 3D Models to Study Tumor and Immune Cell Recruitment Following Normal Tissue Radiation Damage. 2nd Biomedical Engineering and Instrumentation Summit; 4/2021.
6. **Rafat M**. Radiation-Induced Inflammation and Normal Tissue Damage in Breast Cancer Recurrence. **Student Invited Speaker**. Vanderbilt University 19th Annual Retreat for Cancer Biology; 10/2019.
7. **Rafat M**. The Role of Macrophages in Promoting Breast Cancer Recurrence Following Radiotherapy. Vanderbilt University Medical Center Radiation Oncology Research Forum; 4/2019.
8. **Rafat M**. Evaluating the Role of the Tissue Microenvironment in Breast Cancer Recurrence. Biomedical Engineering Seminar. Vanderbilt University; 12/2018.
9. **Rafat M**. Deconstructing the Tumor and Tissue Microenvironment. Universidad de Los Andes (Bogotá, Colombia), Department of Biomedical Engineering; 10/2018.
10. **Rafat M**. Macrophages Promote Circulating Tumor Cell-Mediated Local Recurrence Following Radiation Therapy. Vanderbilt Cancer Biology Science Hour; 04/2018.
11. **Rafat M**. CD8+ T cells Prevent Circulating Tumor Cell-Mediated Local Recurrence Following Radiation Therapy in Triple Negative Breast Cancer. Vanderbilt Center for Bone Biology Seminar; 03/2018.
12. **Rafat M**. CD8+ T Cells Inhibit Tumor Cell Migration to Irradiated Normal Tissues. Emerging Scholars in Engineering Lecture. Vanderbilt University School of Engineering; 10/2016.
13. **Rafat M**. Normal Tissue Irradiation Promotes Tumor and Immune Cell Infiltration in a Breast Cancer Model. Biomechanical Research Symposium. Stanford University; 05/2016.

SELECTED CONFERENCE ORAL PRESENTATIONS

1. Hacker B, Herman D, Lin E, Questell A, Hedges R, **Rafat M**. Macrophage Infiltration Following Normal Tissue Radiation Drives Triple Negative Breast Cancer Invasion via IL-6 Signaling. Biomedical Engineering Society Annual Meeting; 10/2022.
2. Berumen G, Ramgiri A, **Rafat M**. Extracellular Vesicle Secretion from Irradiated Fibroblasts Drives Cell Phenotype in Breast Cancer. Biomedical Engineering Society Annual Meeting; 10/2022.

3. Northcutt L, Questell A, Rhoades J, **Rafat M**. A Tunable, Bone Marrow Mimetic Microenvironment Helps Elucidate How Stiffness Dictates Breast Cancer Cell Invasiveness and Proliferation in the Bone Marrow. Cancer and Bone Society Young Investigator Symposium; 03/2022.
4. Zhu T, Alves SM, Shostak A, Shaub D, **Rafat M**. Radiation-Enhanced Proliferation and Invasion of Breast Cancer Cells in Extracellular Matrix Hydrogels. American Institute of Chemical Engineers Annual Meeting; 11/2021. **Women in Chemical Engineering Travel Award**.
5. Northcutt LA, Questell A, **Rafat M**. Stiffness in a Bone Marrow Microenvironment Dictates Breast Cancer Cell Invasiveness and Proliferation. American Institute of Chemical Engineers Annual Meeting; 11/2021.
6. Corn KC, Britto L, **Rafat M**. Irradiated Breast Tissue Cells are Metabolically Altered and Influence Breast Cancer Recurrence. Biomedical Engineering Society, Annual Meeting; 10/2021.
7. Berumen G, **Rafat M**. Radiation-Induced Extracellular Vesicle Secretion Alters Cell Phenotype in Breast Cancer. Biomedical Engineering Society, Annual Meeting; 10/2021.
8. Hacker BC, Windham MA, Herman DC, Walker AJ, **Rafat M**. Investigating Radiation-Induced Tumor Cell Recruitment with Mammary Organoid Co-Cultures. Biomedical Engineering Society, Virtual Annual Meeting; 10/2020.
9. Zhu T, Alves SM, Shostak A, Rossen NS, **Rafat M**. Radiation-Enhanced Breast Cancer Cell Proliferation and Invasion in Extracellular Matrix Hydrogels. Biomedical Engineering Society, Virtual Annual Meeting; 10/2020. **Women in Chemical Engineering Travel Award**.
10. Hacker BC, Gomez JD, Silvera Batista CA, **Rafat M**. Characterizing the Irradiated Microenvironment with Normal Tissue Mammary Organoids. American Institute of Chemical Engineers, Annual Meeting; 11/2019.
11. Zhu T, Alves SM, Shostak A, Rossen NS, **Rafat M**. Irradiated Extracellular Matrix Hydrogels Enhance Tumor Cell Proliferation and Invasion. American Institute of Chemical Engineers, Annual Meeting; 11/2019.
12. Sherry AD, Newman NB, Chakravarthy AB, **Rafat M**. Acute Post-Radiotherapy Inflammation Predicts Recurrence and Mortality in Stage I-III Triple-Negative Breast Cancer. Vanderbilt-Ingram Cancer Center Breast Cancer Research Program Retreat; 01/2019.
13. Hacker BC, Alves SM, Graves EE, **Rafat M**. Radiation-Induced Changes in Normal Tissues Alter Tumor Cell Recruitment. American Institute of Chemical Engineers, Annual Meeting; 10/2018.
14. Alves SM, Hacker BC, Graves EE, **Rafat M**. Tumor Cell Recruitment is Enhanced Following Radiation-Induced Changes in Cytokine Secretion. Biomedical Engineering Society, Annual Meeting; 10/2018.
15. **Rafat M**, Rossen NS, Shehade H, Wisdom K, Eler J, Giaccia AJ, Graves EE. Radiation-Induced Changes in the Extracellular Matrix Alter the Invasiveness of Heterogeneous Tumors. American Institute of Chemical Engineers, Annual Meeting; 10/2017.
16. **Rafat M**, Aguilera TA, Vilalta M, Bronsart LL, von Eyben R, Jenkins MJ, Afghahi A, Kurian AW, Horst KC, Giaccia AJ, Graves EE. CD8+ T Cells Prevent Circulating Tumor Cell Recruitment After Radiation. 15th International Tumor Microenvironment Workshop; 04/2017.
17. **Rafat M**, Vilalta M, Aguilera TA, Giaccia AJ, Graves EE. Evaluating Microenvironmental Changes Following Normal Tissue Irradiation: The Role of CD8+ T Cells in Breast Tumor Cell Migration *in vivo*. Biomedical Engineering Society, Annual Meeting; 10/2016.
18. **Rafat M**, Vilalta M, Aguilera TA, Giaccia AJ, Graves EE. Normal Tissue Irradiation Promotes Tumor and Immune Cell Infiltration. World Molecular Imaging Congress, Annual Meeting; 09/2015. **Highlight Presentation**.
19. **Rafat M**, Vilalta M, Aguilera TA, Giaccia AJ, Graves EE. Tumor and Immune Cell Infiltration are Enhanced by Irradiation of Normal Tissue. 14th International Tumor Microenvironment Workshop; 08/2015.

20. **Rafat M**, Vilalta M, Aguilera TA, Giaccia AJ, Graves EE. Irradiation of Normal Tissues Stimulates Tumor Cell Migration. AACR-SNMMI Joint Conference; 02/2015.

SELECTED CONFERENCE POSTER PRESENTATIONS

1. Martello S, **Rafat M**. Investigating the Role of Neutrophil-Endothelial Interactions in Triple Negative Breast Cancer Recurrence. Biomedical Engineering Society Annual Meeting; 10/2022.
2. De Vis J, Balbach M, Sherry A, Newman N, Chakravarthy AB, **Rafat M**. Body Composition as a Biomarker for Disease Recurrence in Patients with Triple Negative Breast Cancer. American Society for Radiation Oncology; 10/2022.
3. Corn KC, Britto LS, Mohamed YK, **Rafat M**. Radiation Therapy Induces Metabolic Changes in Fibroblasts and Enhances Metabolic Crosstalk with Triple Negative Breast Cancer Cells. Immunometabolism at the Crossroads of Obesity and Cancer Keystone Symposium; 9/2022.
4. Northcutt L, Questell A, Rhoades J, **Rafat M**. Understanding the Role of Bone Marrow Stiffness in Tumor Cell Colonization and Metastasis. American Society for Bone and Mineral Research Annual Meeting; 09/2022.
5. Zhu T, Shostak A, **Rafat M**. The Irradiated Extracellular Matrix Promotes Breast Cancer Recurrence. Signal Transduction by Engineered Extracellular Matrices Gordon Research Conference; 7/2022. **T. Zhu selected as Gordon Research Seminar discussion leader.**
6. Hacker B, Herman D, Lin E, Questell A, Hedges R, **Rafat M**. Macrophage Infiltration Following Radiation-Induced Normal Tissue Injury Drives Triple Negative Breast Cancer Invasion via IL-6 Signaling. Resolution of Inflammation Keystone Symposium; 6/2022. **Russell G. Hamilton Graduate Leadership Development Institute Travel Award.**
7. Berumen G, **Rafat M**. Radiation-Induced Secretion of Extracellular Vesicles Drives Phenotypic Changes within the Breast Tumor Microenvironment. International Society of Extracellular Vesicles Annual Meeting; 5/2021.
8. Todd VM, Vecchi LA, Snow KP, Himmel L, **Rafat M**, Johnson RW. HIF signaling in breast tumors controls spontaneous tumor dissemination in a site-specific manner. American Association of Cancer Research, Annual Meeting; 4/2021.
9. Glass EB, Roy S, Manning AE, Hacker BC, Haycock CP, Bullock KK, Dollinger BR, **Rafat M**, Yull FE, Kim YJ, Girogiro TD. Macroporous Cryogels as Pro-Inflammatory Drug Delivery Depots for Localized Reprogramming of TAMs to Induce Anti-Tumor Immunity. American Association for Cancer Research, Annual Meeting; 04/2021.
10. Corn KC, Britto LS, **Rafat M**. Investigating the Impacts of Obesity and Metabolic Responses to Radiation Therapy on Triple Negative Breast Cancer Recurrence. Tumor Metabolism and the Microenvironment Keystone Symposia Conference; 1/2021.
11. Britto L, Corn KC, **Rafat M**. Irradiation Alters Adipocyte Expression of Glucose Transporter Type 1 and Type 4. Annual Biomedical Research Conference for Minority Students, Virtual Annual Meeting; 11/2020. **The Virtual Experience Presentation Award.**
12. Northcutt LA, Suarez-Arnedo A, Questell A, **Rafat M**. Morphology and Proliferation of Breast Cancer Cells is Altered in a Bone Marrow Mimetic Microenvironment. National Organization for the Professional Advancement of Black Chemists and Chemical Engineers, Virtual Annual Meeting; 9/2020. **2nd Place Poster Prize.**
13. Hacker BC, Gomez JD, Silvera Batista CA, **Rafat M**. Irradiated Mammary Organoids to Model Macrophage Recruitment. Biomedical Engineering Society Annual Fall Meeting; 10/2019.
14. Corn KC, **Rafat M**. Evaluating the Impact of Radiation Damage on Adipose Tissue in the Tumor Microenvironment. Biomedical Engineering Society Annual Fall Meeting; 10/2019.
15. Zhu T, Alves SM, Shostak A, Rossen NS, **Rafat M**. Tumor Cell Proliferation and Invasion are Enhanced in Irradiated Extracellular Matrix Hydrogels. Biomedical Engineering Society Annual Fall Meeting; 10/2019.

16. Sherry AD, Newman NB, Chakravarthy AB, **Rafat M**. Acute Post-Radiotherapy Inflammation Predicts Recurrence and Mortality in Stage II-III Triple-Negative Breast Cancer. American Society for Radiation Oncology; 09/2019.
17. Hacker BC, Alves SM, Jiang D, Koong AC, Giaccia AJ, Graves EE, **Rafat M**. The Irradiated Tissue Microenvironment and its Role in Breast Cancer Recurrence: Enhanced Macrophage Infiltration Promotes Tumor Cell Recruitment. American Association for Cancer Research, Annual Meeting; 04/2019.
18. **Rafat M**, Rossen NS, Shehade H, Wisdom K, Eler J, Giaccia AJ, Graves EE. Heterogeneous Tumor Invasiveness is Influenced by Radiation-Induced Changes to the Extracellular Matrix. Biomedical Engineering Society, Annual Fall Meeting; 10/2017.
19. **Rafat M**, Vilalta M, Aguilera TA, Giaccia AJ, Graves EE. Irradiation of Normal Tissues Stimulates Tumor Cell Migration. 7th Annual Center for Biomedical Imaging at Stanford Symposium; 4/2015. **Best Poster Award**.
20. **Rafat M**, Vilalta M, Aguilera TA, Giaccia AJ, Graves EE. Tumor and Immune Cell Infiltration are Enhanced by Irradiation of Normal Tissues in Immunocompromised Mice. American Association for Cancer Research, Annual Meeting; 04/2016.

Teaching

Vanderbilt University	Nashville, TN
<i>Instructor, Undergraduate Course</i>	Fall 2020/2021/2022
ChBE 4900W: Chemical Engineering Laboratory II, 30 Lectures	
<i>Instructor, Dual Senior/Graduate Course</i>	Spring 2019/2021
ChBE 3890/5890: Biomaterials for Drug Delivery, 38 Lectures	
<i>Instructor, Undergraduate Course</i>	Spring 2018/2020
ChBE 3350: Mass Transfer and Rate-Based Separations, 39 Lectures	
<i>Invited Lecturer, Graduate Course</i>	Nov. 2020
BME 8901: Engineering Approaches to Cancer, 1 lecture	
<i>Invited Lecturer, Graduate Course</i>	Oct. 2019
IMS 5320: Nanoscale Science and Engineering, 1 lecture	
Stanford Pre-Collegiate Studies Program	Stanford, CA
<i>Guest Instructor</i>	Jul. 2014
Topics in Biosciences and Biotechnology: Cancer Biology Section	
Harvard Engineering and Applied Sciences	Cambridge, MA
<i>Head Teaching Fellow</i> , Introduction to Fluid Mechanics and Transport Processes (Undergraduate course)	Jan. 2009-May 2009
<i>Teaching Fellow</i> , Drug Delivery (Graduate course)	Sep. 2007-Jan. 2008

Research Training

Graduate Students	
Steven Alves, ChBE MS	2018-Aug. 2019
Thesis Title: Radiation Effects on Breast Tissue-Derived Extracellular Matrix Hydrogels	
Benjamin Hacker, ChBE PhD	2018-2023
NCI F31	
Kevin Corn, ChBE PhD	2019-Present
ITED T32	

Tian Zhu, ChBE PhD	2019-Present
Logan Northcutt, Cancer Biology PhD IBSTO T32	2019-Present
Gregory Berumen Sánchez, ChBE PhD ITED T32; NSF GRFP	2019-Present
Shannon Martello, ChBE PhD	2020-Present
Candace Grisham, MSTP/BME PhD MSTP T32	2021-Present
McKenzie Windham, BME PhD NSF GRFP	2022-Present

Undergraduate Researchers

Elena Irvine, ChBE Vanderbilt University Summer Research Program (VUSR)	2018-2019
Akrimi Fauzi, ChBE '19 VUSE Summer Research Program	2018-2019
Drake Shaub, ChBE '21 VUSR	2018-2021
Anesha Walker, Biology (TSU) '20 Meharry-Vanderbilt-TSU Cancer Partnership (MVTCP) Program	2018-2020
Anastasia Shostak, ChBE VICC CURE Program; VUSR; NIH Maximizing Access to Research Careers (MARC) Scholars Program	2018-Present
Yoanna Ivanova, BME '21 SyBBURE Searle Undergraduate Research Program, Clark Scholar; NSF GRFP	2019-2021
Dana Herman, Biochemistry '22 SyBBURE Searle Undergraduate Research Program	2019-2022
Lucy Britto, BME '22 MARC Scholars Program; NSF GRFP	2020-2022
Ally Questell, BME SyBBURE Searle Undergraduate Research Program	2020-Present
Akhila Ramgiri, ChBE/BME SyBBURE Searle Undergraduate Research Program	2020-Present
Erica Lin, Biological Sciences VUSR; FUS Foundation Global Scholar	2021-Present
Ian Kusher, Biology (Sewanee) '22 Vanderbilt Summer Science Academy	2021
Youssef Mohamed, ChBE VUSE Summer Research Program	2021-Present
Rebecca Hedges, ChBE VUSR	2021-Present
Abtin Ghelmansaraei, BME VUSE Summer Research Program	2022-Present
Neelesh Raj, ChBE MARC STEM Transition and Retention (START) Program	2022

Service

Membership in Professional Societies

American Association for Cancer Research (AACR)	2015-Present
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World Molecular Imaging Society (WMIS)	2014-Present
Materials Research Society (MRS)	2011-Present
American Association for the Advancement of Science (AAAS)	2008-Present
Biomedical Engineering Society (BMES)	2007-Present
Tau Beta Pi Massachusetts Beta Chapter (TBP)	2006-Present
American Institute of Chemical Engineers (AIChE)	2005-Present
Society of Women Engineers (SWE)	2004-Present

Journal Reviewer

Stroke; Translational Research; The International Journal of Biochemistry & Cell Biology; PLoS One; PLoS Computational Biology; International Journal of Radiation Oncology, Biology, Physics; European Journal of Pharmacology; Cellular and Molecular Bioengineering; Clinical Science; International Journal of Radiation Biology; Frontiers in Oncology; Acta Biomaterialia; Biomaterials Science; Journal of Extracellular Vesicles; Cancer Communications; Nature Communications

Conference Organization

ACS BIOT Meeting: New Technologies in Cell & Microbiome Eng. and Stem Cell Therapy Co-Chair	2021
BMES Annual Meeting: Biomaterials for Immunoengineering Co-Chair	2020
Cancer Technologies Co-Chair	2018-Present
Diversity Committee	2019-2022
AIChE Annual Meeting: Hydrogel Biomaterials; Cells, Organs, and Labs on a Chip Co-Chair	2020-Present
Women in Chemical Engineering (WIC) Board Member	2019-Present
Biomimetic Materials Co-Chair	2019
Engineering in Cancer Biology; Biomaterials for Immunological Applications Co-Chair	2018

Grant Reviewer

National Science Centre Poland	2022
Israel Science Foundation	2022
Austrian Science Fund	2021
NIH Early Career Reviewer (Cancer Immunopathology and Immunotherapy)	2020
National Science Foundation	2019-Present
DoD BCRP Reviewer	2019-Present

Service to the Department and University

Tau Beta Pi Faculty Adviser	2021-Present
Cancer Biology Diversity & Inclusion Committee	2020-Present
ChBE Department Seminar Series Co-Organizer	2019-Present
ChBE Class of 2023 Undergraduate Advisor	2019-Present
Quantitative and Chemical Biology (QCB) Admissions and Advisory Committee	2019-Present
Interviewer for the QCB Program	2019-Present
Interviewer for Medical Scientist Training Program (MSTP) Applicants	2019-Present
ChBE Department Graduate Committee	2018-Present
Thesis Committees	
Payton Stone, ChBE	2022-Present
Jordan Hill, BME	2022-Present
Israel Ortiz, BME	2022-Present
Rachel Moen, ChBE	2022-Present
John Rector, ME	2022-Present
Taylor Sheehy, BME	2022-Present

Taylor Scott, ChBE	2021-Present
Sharareh Ameli, PMI	2021-Present
Maria Cavestany Lopez, BME	2021-Present
Brandie Taylor, Cancer Biology	2021-Present
Ela Contreras Panta, CDB	2021-Present
Matthew Rogers, ChBE	2020-2021
Alexis Yates, IMS	2020-Present
Jenna Dombroski, BME	2020-Present
Paul Taufalele, BME	2020-Present
Joshua Greenlee, BME	2020-2023
Jenna Mosier, BME	2020-Present
Wendy Bindeman, Cancer Biology	2020-Present
Carlos Detres Roman, Cancer Biology	2020-Present
Courtney Edwards, Cancer Biology, MSTP	2020-2022
Javier Gomez, ChBE	2020-2023
Jamisha Francis, Microbe-Host Interactions	2020-2023
Yajuan Shi, ChBE	2019-2022
Carcia Carson, BME	2019-2022
Jessalyn Baljon, BME	2019-2023
Gregory Lowen, ChBE	2019-2022
Xiaona Wen, ChBE	2019-2021
Evan Glass, BME	2019-2021
Samantha Schwager, BME	2019-2022
Vilma Jallinoja, CPB	2019-2022
Michael Raddatz, BME, MSTP	2019-2020
Kyle Garland, ChBE	2018-2021
Christian Palmer, ChBE	2018-2023
Sarah Sacco, ChBE	2018-2022
Kazi Tasneem, ChBE	2018-2021

Mentoring and Outreach

School for Math and Science at Vanderbilt (SSMV) Mentor	2019-Present
Vanderbilt Undergraduate Summer Research Program (VUSRP) Mentor	2018-Present
VUSE Summer Research Program Mentor	2018-Present
Meharry-Vanderbilt-TSU Cancer Partnership (MVTCP) Program Mentor	2018-Present
VICC Cure High School Program Mentor	2018-Present
Science Club for Girls Mentor	2008-2012
NSF REU Mentor	2007-2010

Professional Experience

Stanford Women in Science and Engineering <i>Radiation Oncology Representative</i>	Stanford, CA 2012-Present
Allurion Technologies, Inc. <i>Scientific Consultant</i>	Cambridge, MA 2011-2012
Harvard Topics in Bioengineering Seminar Series <i>Co-Founder</i>	Cambridge, MA 2009-2012
Harvard Graduate Women in Science and Engineering <i>Board Member and Bioengineering Representative</i>	Cambridge, MA 2008-2012