

Marjan Rafat, PhD

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Education

Harvard University

Cambridge, MA

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

May 2012

Massachusetts Institute of Technology (MIT)

Cambridge, MA

- SB in Chemical Engineering
- Minors in Biomedical Engineering and Chemistry

Jun. 2006

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

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

Rafat (PI)

04/01/18 - 03/31/21

NIH NCI

\$747,000

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

Engineering Immunity Pilot Grant

Bardhan (PI)

04/01/18-06/30/18

Vanderbilt University

\$8,000

Image-Guided Combinatorial Photothermal Immunotherapy with Light-Activated Liposomes

The goal of this project is to engineer multi-functional immunoactive liposomes that induce systemic immunity and memory responses for targeting tumors.

Role: Co-I

Awards and Fellowships

Stanford Bio-X Travel Award	2017
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
World Molecular Imaging Congress Student Travel Stipend	2014, 2015
Advanced Research Center for Medical Physics (ARCMP) Travel Award	2014
Canceropole Grand Ouest Travel Grant Award	2013
NIH NRSA Postdoctoral Fellowship in the Radiation Sciences (T32)	2012-2013; 2015-2016
Biomedical Engineering Society Travel Grant Award	2010, 2011
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

Peer-Reviewed Publications

1. 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.
2. **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.
3. 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.
4. **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.
5. 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.
6. 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.
7. 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.

8. 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.
9. 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.
10. Lartey FM, Ahn GO, Ali R, Rosenblum S, Shen B, Miao Z, Arksey N, Vilalta M, **Rafat M**, Liu H, Chen JW, Palmer T, Chin FT, Guzman R, Loo BW Jr, Graves EE. The Relationship Between Serial [(18)F]JPBR06 PET Imaging of Microglial Activation and Motor Function Following Stroke in Mice. *Molecular Imaging & Biology*. 2014; 16(6): 821-829.
11. **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.
12. **Rafat M**, Rotenstein L, You JO, Auguste DT. Dual Functionalized PVA Hydrogels that Adhere Endothelial Cells Synergistically. *Biomaterials*. 2012; 33(15): 3880-3886.
13. You JO, **Rafat M**, Auguste DT. Cross-Linked, Heterogeneous Colloidosomes Exhibit pH-Induced Morphogenesis. *Langmuir*. 2011; 27(18): 11282-11286.
14. 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.
15. **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.
16. **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.

Pending Peer-Reviewed Publications

1. Carozza JA, Böhnert V, Nguyen K, Shaw KE, **Rafat M**, Graves EE, Glenn J, Smith M, Li L. 2'3'-cGAMP is a Paracrine Signal Secreted by Cancer Cells and Detected by the Host Immune System. 2018; Under Review.
2. Hacker BC, Gomez JD, Silvera Batista CA, **Rafat M**. Growth and Characterization of Irradiated Organoids from Mammary Fat Pad Tissue. 2018; Under Review.
3. Alves SM, Shostak A, Rossen NS, **Rafat M**. Studying Normal Tissue Radiation Effects using Extracellular Matrix Hydrogels. 2018; Under Review.
4. **Rafat M**, El Kaffas A, Graves EE. Non-Invasive Monitoring of Normal Tissue Radiation Damage using Ultrasound Elastography. 2018; In preparation.

Review Articles

1. 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.
2. **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.

Book Chapter

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.

Research Highlights

1. **Rafat M**. Enzymatically crosslinked microporous hydrogel scaffolds that form *in situ* promote dermal healing. *Regenerative Medicine*. 2015; 10(4): 391-392.
2. **Rafat M**. Real-time Evaluation of Cell Viability using Nanoprobes. *Regenerative Medicine*. 2015; 10(4): 391-392.

3. **Rafat M.** Harnessing the immune response for successful scaffold vascularization. *Regenerative Medicine*. 2015; 10(1): 15-16.
4. **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.

Invited Talks

1. **Rafat M.** Macrophages Promote Circulating Tumor Cell-Mediated Local Recurrence Following Radiation Therapy. Vanderbilt Cancer Biology Science Hour; 04/2018.
2. **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.
3. **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.
4. **Rafat M.** Normal Tissue Irradiation Promotes Tumor and Immune Cell Infiltration in a Breast Cancer Model. ME 389 – Biomechanical Research Symposium. Stanford University; 05/2016.

Selected Oral Presentations

1. **Rafat M,** Rossen NS, Shehade H, Wisdom K, Erler 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.
2. **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.
3. **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 Fall Meeting; 10/2016.
4. **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).
5. **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.
6. **Rafat M,** Vilalta M, Aguilera TA, Giaccia AJ, Graves EE. Irradiation of Normal Tissues Stimulates Tumor Cell Migration. AACR-SNMMI Joint Conference; 02/2015.
7. **Rafat M,** Vilalta M, Giaccia AJ, Graves EE. Tumor Cell Migration is Enhanced by Normal Tissue Irradiation in a Preclinical Mouse Model. World Molecular Imaging Congress, Annual Meeting; 09/2014.
8. **Rafat M,** Bazalova M, Palma BA, Kozak MM, Jiang D, Dunning M, McCormick DJ, Nelson JL, Hensing E, Lartey FM, Graves EE, Koong AC, Maxim PG, Loo BW. Radiobiological Advantage of Very Rapid Irradiation. American Association of Physicists in Medicine, Annual Meeting; 07/2014.
9. **Rafat M,** Bazalova M, Lartey FM, Graves EE, Maxim PG, Loo BW. Biological Impact of Very Rapid Irradiation. Cancerpole Grand Ouest, The Future of Radiation Oncology: Imaging, Dosimetry, Biology & Therapy Workshop; 09/2013.

Selected Poster Presentations

1. **Rafat M,** Rossen NS, Shehade H, Wisdom K, Erler 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.
2. **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).

3. **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; 04/2016.
4. **Rafat M**, Vilalta M, Giaccia AJ, Graves EE. Normal Tissue Irradiation Promotes Tumor Cell Migration. American Society for Radiation Oncology; 09/2014.
5. **Rafat M**, Bazalova M, Palma BA, Kozak MM, Jiang D, Dunning M, McCormick DJ, Nelson JL, Hemsing E, Lartey FM, Graves EE, Koong AC, Maxim PG, Loo BW. Impact of Very Rapid Irradiation on Clonogenic Survival. American Society for Radiation Oncology; 09/2014.

Teaching and Mentoring

Vanderbilt University

Instructor, Undergraduate Course

ChBE 3350: Mass Transfer and Rate-Based Separations, 39 Lectures

Nashville, TN
Jan. 2018-Apr. 2018

Stanford Pre-Collegiate Studies Program

Guest Instructor

Topics in Biosciences and Biotechnology: Cancer Biology Section

Stanford, CA
Jul. 2014

Harvard Engineering and Applied Sciences

Head Teaching Fellow, Introduction to Fluid Mechanics and Transport Processes (Undergraduate course)

Teaching Fellow, Drug Delivery (Graduate course)

Cambridge, MA
Jan. 2009-May 2009

Sep. 2007-Jan. 2008

Science Club for Girls

Mentor

Cambridge, MA
Jan. 2008-May 2012

NSF Research Experiences for Undergraduates

Mentor

Cambridge, MA
Jun. 2007-Aug. 2010

Professional Associations

American Association for Cancer Research (AACR)

2015-Present

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

Professional Experience

Reviewer

PLoS One

Nov. 2017-Present

The International Journal of Biochemistry & Cell Biology

Sep. 2016-Present

Translational Research

Jul. 2016-Present

Stroke, Journal of the American Heart Association

Apr. 2010-Present

Stanford Women in Science and Engineering

Radiation Oncology Representative

Stanford, CA
Oct. 2012-Present

Allurion Technologies, Inc.

Scientific Consultant

Cambridge, MA
Mar. 2011-Sep. 2012

Harvard Topics in Bioengineering Seminar Series

Co-Founder

Cambridge, MA
Jan. 2009-May 2012

Harvard Graduate Women in Science and Engineering

Board Member and Bioengineering Representative

Cambridge, MA
Sep. 2008-May 2012