Doctoral Dissertation Defense Announcement

Computational and Experimental Studies on Vascular Targeted Plasmonic Thermal Ablation of Solid Tumors

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Date: Wednesday, May 15, 2024

Time: 1 PM (CST)

Defense Location: MEB Discovery Classroom, M3750

Zoom: https://mcw-edu.zoom.us/s/92948386095

Graduate Studies:

Advanced Computational Physics
Advanced Quantum Mechanics
Advanced Classical Mechanics
Advanced Statistical Mechanics
Advanced Electrodynamics
Advanced Optics
Solid State Physics
Scanning Electron Microscopy (SEM).
Physics of Magnetic Resonance Imaging (MRI)
Digital Image Processing
Machine Learning

Linear Algebra

Biostatistics

System Physiology

Statistical Learning

Advanced Machine Learning

Reading and Research

Research Ethics

Research Ethics Discussion Series

Doctoral Dissertation
Currently, chemotherapy, radiotherapy, surgery, and local ablative therapies are the primary techniques for cancer treatment. However, often local ablative methods just delay the relapse of the cancer and critically depend on the physician's skills to achieve tumor control and reduce off-target treatment effects. Gold nanoparticle mediated photothermal ablation (PTA) has illustrated promising results in animal studies in the past few years. In this method low energy near infrared (NIR) laser illumination is delivered to the unhealthy tissue pretreated with nanoparticles designed to absorb NIR light. NIR plasmonic resonance bearing gold nanoparticles with enhanced optical absorption can be targeted to tumor and increase thermal energy delivery to the tumor, while sparing the healthy tissue. Image-guided PTA for precise positioning of laser source can potentially decrease the off-target damage of the treatment. Despite variety of proposed geometry and material compositions for gold-based nanoparticles, and success in the animal studies, the safety and tumor specific thermal therapy delivery of these nanoparticles in larger spatial scales encountered in human subjects have not been fully studied. Also, the germline inherited characteristics in tumor vasculature which affect nanoparticle delivery and distribution and the effects of tumor microenvironment have not been considered in treatment with PTA methods. In this study, we have designed and exploited computational and experimental models to investigate and understand the effect of tumor vascular microenvironment on the treatment outcome. Moreover, we will target the notch-DLL4 overexpression in the tumor microenvironment by nanoparticles to possibly increase the efficacy of nanoparticle distribution.
Education

Medical College of Wisconsin-Marquette University Milwaukee, WI, US
Biomedical Engineering, PhD, August 2017-current

Central Michigan University Mount Pleasant, MI, US
Physics, Master of Science, January 2015-August 2017

University of Zanjan Zanjan, Iran
Physics, Master of Science,

University of Tabriz Tabriz, East Azarbajjan, Iran
Physics, BSc.,

Research Experience
2. Computational simulation of Microwave and nanogold-mediated photothermal ablation of liver tumors.
3. Drug delivery.
4. Design, modeling, and synthesis of gold-based nanoparticles for imaging and photo-thermal ablation, and
   Multimodal optical-MRI contrast agent development.
   Supervisors: Dr. Amit Joshi (2018-present)

Characterization of Bio-Degradable Polymers
   Supervisors: Dr. Bingbing Li (2015-2017)

Geometry Optimization of Silicon Doped Carbon Nanotubes (CNT) Using Density Functional Theory (DFT) in Gaussian space
   Supervisors: Dr. Veronica Barone (2015-2017)
Publications

- Retrospective validation of a simulation platform for benchmarking plasmonic thermal ablation of liver tumors against microwave ablation, Mir Hadi Razeghi Kondelaji, Abdul-Kareem Parchur, Sarah B. White, Amit Joshi, (Computers in Physics and Medicine, 2024). Under submission


- X-ray and MR contrast bearing nanoparticles enhance the therapeutic response of image guided radiation therapy for oral cancer, Gayatri Sharma, Mir Hadi Razeghi Kondelaji, Abdul K. Parchur, Shayan Shafiee, Jaidip M. Jagtap, Brian Fish, Meetha Medhora, Carmen Bergom, Eric Paulson, William A Hall, Amit Joshi, (Technology in Cancer Research and Treatment, 2023)


Conference Presentations

- Mir Hadi Razeghi Kondelaji, Joseph Zenga, Christopher Hansen, Anne Frei, Heather A. Himburg, Amit Joshi, Validation of nanoparticle mediated photodynamic therapy for drug resistant patient derived Head and Neck Cancer xenograft models (Oral Presentation, Accepted for BMES annual seminar, Seattle, October 2023)

- Mir Hadi Razeghi Kondelaji, Guru Prasad Sharma, Jaidip Jagtap, Shayan Shafiee, Christopher Hansen, Tracy Gasperetti, Anne Frei, Dana Veley, Jayashree Narayanan, Brian L. Fish, Abdul K. Parchur, El-Sayed H. Ibrahim, Meetha Medhora, Heather A.
Himburg, Amit Joshi, NIR 2nd window imaging to assess the impact of inherited Notch-DLL4 expression on pulmonary radiation injury, World Molecular Imaging Conference, Miami Beach, FL 2022 (Oral Presentation)

- **Mir Hadi Razeghi Kondelaji**, Venkat Gogineni, Sarah B White, and Amit Joshi, Virtual platform for assessing liver tumor ablation margin: Microwave ablation vs Intravascular Plasmonic Photothermal Ablation, Society of Interventional Oncology conference, San Francisco, CA 2022 (Oral Presentation)

- **Mir Hadi Razeghi Kondelaji**, Venkat Gogineni, Sarah B White, and Amit Joshi, Retrospective validation of a virtual platform for personalized thermal ablation planning of liver tumors: Microwave ablation vs Intravascular Plasmonic Photothermal Ablation, Radiological Society of North America (RSNA), Chicago, IL, 2021.

- **Mir Hadi Razeghi Kondelaji**, Abdul Kareem Parchur, and Amit Joshi, Simulation Guided Design of Multimodal MRI-Optical-Photothermal Gold Nano constructs, BMES, Atlanta, GA (October 2018 Conference)

- **Mir Hadi Razeghi Kondelaji**, Abdul Kareem Parchur, Venkat Gogineni, Sarah B White, and Amit Joshi, Feasibility of Ablating Colorectal Cancerous Liver Metastasis via Site-Specific Image Guided Magneto-Plasmonic Nanoparticle Delivery and Photothermal Ablation, BMES, Atlanta, GA (October 2018 Conference)