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Engineering & Scientific Consulting

Anirudh Sharma, Ph.D.

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Professional Profile

Dr. Sharma is an experienced electrical engineer with over 10 years of expertise at the interface of electrical engineering, materials science, and translational biomedical sciences. Through his PhD, postdoctoral research and published work, he has demonstrated a strong expertise in experimental and computational electromagnetics and nanomagnetism, design, verification and validation of biomedical feedback control devices, thermal therapies for cancer, nanoparticle-based cancer therapies, electromagnetic RF technologies for organ cryopreservation and electromagnetic interference (EMI/EMC) in medical devices and implants. Dr. Sharma has co-chaired various symposia at international conferences focused on biodetection, therapy and biomedical applications of magnetic materials.

Academic Credentials & Professional Honors

Ph.D., Electrical Engineering, University of Minnesota, 2015

M.S., Electrical Engineering, University of Minnesota, 2011

B.E., Electrical Engineering, University of Mumbai, India, 2007

Co-Chair for Magnetic Biodetection and Therapy II session at the 2022 joint MMM-Intermag conference.

Co-Chair for Biomedical Applications I at the 65th Annual Conference on MMM 2020.

First Prize in Institute of Engineering in Medicine Poster Competition, 2014 and 2021, UMN.

Student Travel Award and Invited talk, 2013 MMM/Intermag, Chicago.

Student Travel Award and Symposium Assistant, 2010 MRS Fall meeting, Boston.

Academic Appointments

Postdoctoral Fellow, Johns Hopkins University School of Medicine, Jul 2021 – Feb 2023, Sep 2015 – Feb 2018.

Postdoctoral Associate, University of Minnesota (UMN), Feb 2018 - Jul 2021.

Graduate Research Assistant, University of Minnesota (UMN), Jun 2009 – Jul 2015.

Prior Experience

Postdoctoral Fellow, The Johns Hopkins University School of Medicine, Jul 2021 – Feb 2023 and Sep 2015 – Feb 2018.

Postdoctoral Associate, University of Minnesota (UMN), Feb 2018 - Jul 2021.

Graduate Research Assistant, University of Minnesota (UMN), Jun 2009 – Jul 2015.

Professional Affiliations

Member of Society for Thermal Medicine, 2015-Present

Member of Society of Cryobiology, 2018-2021

Member of Materials Research Society, 2011-2015

Patents

US Patent Application US-20220071196: System and Method for Cryopreservation of Tissues, March 2022 (Lee CY, Bischof JC, Finger EB, Sharma A).

Publications

Sharma, A., et al. Design of a temperature-feedback controlled automated magnetic hyperthermia device. *Frontiers in Thermal Engineering*, 2023, vol. 3, p.1131262.

Sharma A., et al. Validation of a Temperature-Feedback Controlled Automated Magnetic Hyperthermia Therapy Device. *Cancers*, 2023, 15(2), 327.

Sharma, A., et al. Nanoparticle-Based Interventions for Liver Transplantation. *International Journal of Molecular Sciences*, 2023, 24(8), 7496.

Sharma A., Lee C.Y., et al. Cryopreservation of Whole Rat Livers by Vitrification and Nanowarming. *Annals of Biomedical Engineering*, 2022, 1-12.

Sharma A., Cressman E., et al. Current Challenges in Image-guided Magnetic Hyperthermia Therapy for Liver Cancer. *Nanomaterials*, 2022, 12(16), 2768.

Sharma A., Rao J.S., Han Z., et al. Vitrification and Nanowarming of Kidneys. *Advanced Science*, 2021;2101691.

Ring H.L.*, Sharma A.*, Ivkov R. and Bischof J.C. "The impact of data selection and fitting on SAR estimation for magnetic nanoparticle heating." *International Journal of Hyperthermia*, 37(3), pp.100-107, 2020 (*equal contribution).

Ring H.L., Gao Z.; Sharma A., Han Z., et al., "Imaging the distribution of iron oxide nanoparticles in hypothermic perfused tissues." *Magnetic Resonance in Medicine*, 2020, 83, no.5:1750-1759.

Korangath P., Barnett J.D., Sharma A., et al. Nanoparticle Interactions with Immune Cells Dominate Tumor Retention and Induce T Cell-Mediated Tumor Suppression in Models of Breast Cancer. *Science Advances*, 2020, 6, eaay1601.

Sharma A., Özyayral S., Caserto J.S., et al. Increased uptake of doxorubicin by cells undergoing heat stress does not explain its synergistic cytotoxicity with hyperthermia. *International Journal of*

Hyperthermia, 2019, 36:712–720.

Sharma A., Bischof J.C. and Finger E.B. “Liver Cryopreservation for Regenerative Medicine Applications.” Regenerative Engineering and Translational Medicine, 2019, pp.1-9.

Sharma A., Cornejo C., Mihalic J., et al. Physical characterization and in vivo organ distribution of coated iron oxide nanoparticles. Scientific Reports, 2018, 8:4916.

Sharma A., DiVito M., et al. Alignment of collagen matrices using magnetic nanowires and magnetic barcode readout using first order reversal curves (FORC), Journal of Magnetism and Magnetic Materials, 2017, 459, pp.176-181.

Sharma A., Orlowski G.M., Zhu Y., et al. Inducing cells to disperse nickel nanowires via integrin-mediated responses. Nanotechnology, 2015, 26:135102.

Sharma A.; Zhu Y.; Thor S.; Stadler B.J.H. et al. “Magnetic barcode nanowires for Osteosarcoma cell control, detection and separation,” IEEE Transactions on Magnetics, 2013, Vol.49, No.1.

Complete list of publications and book chapters:

<https://scholar.google.com/citations?user=4EomoCUAAAAJ&hl=en&oi=ao>

Presentations

Sharma, A. et al., “RF Rewarming for improved cryopreservation of kidneys.” CRYO2020, Jul 2020

Sharma, A.; Gao, Z.; Ring, H.; Ivkov, R.; Bischof, J. “Specific power loss demands on magnetic nanoparticles when scaling-up in hyperthermia and nanowarming applications.”, Nanoengineering for Medicine and Biology (ASME), August 2018 (talk).

Sharma, A.; Kandala, S.K.; Soetaert, F.; Dennis, C.; Ivkov, R. “Magnetostuctural characterization of nanoparticles for applications in hyperthermia”, International Conference on Fine Particle Magnetism, Gaithersburg, June 2016 (talk).

Sharma, A.; Soetaert, F.; Kandala, S.K.; Dennis, C.; Ivkov, R. “Magnetostuctural characterization of iron oxide nanoparticles for cancer hyperthermia applications”, International Congress of Hyperthermic Oncology, New Orleans, April 2016. (talk)

Sharma, A. et al., “Manipulations of Cells using Au-capped Ni Nanowires”, MMM/Imag 1 conference, Chicago, Jan 2013 (invited talk).

Project Experience

In his previous position as Postdoctoral Fellow in the Department of Radiation Oncology at the Johns Hopkins University School of Medicine, Dr. Sharma designed MRI and CT image-guided and computational modeling-based treatment planning workflows that predicted the treatment efficacy of magnetic hyperthermia therapies in canine glioblastoma patients. He experimentally designed, verified, and validated temperature feedback control devices to optimize the thermal treatments in canine patients suffering from glioblastoma. He further used MRI images to generate 3D anatomical models which he then used to perform finite element modeling of coupled EM and heat transfer equations using for predictive modeling and therapy optimization. Dr. Sharma has also used iron oxide nanoparticles as T2* and T1 MR contrast agents for predictive modeling of heat generation in cryopreserved organs and for magnetic hyperthermia. Additionally, Anirudh has calibrated RF coils, MRI-safe fiber optic sensors,

measured stray magnetic fields to ensure safety compliance, improved SNR in devices susceptible to RF interference through shielding and digital signal processing.

As part of his doctoral research at the University of Minnesota, Dr. Sharma specialized in magnetic nanoparticle design, synthesis, coating and characterization for biomedical and photonic applications. Through this research, he addressed important engineering questions pertaining to the design and properties of nanoparticles, including shape, size, composition, magnetic properties for sensing, surface functionalization, nanoparticle aggregation and integration of this technology with various imaging techniques and platforms. Additionally, he has significant experience in innovating electromagnetic RF technologies and process optimization for image-guided cryopreservation of tissues and organs.

Dr. Sharma joined Exponent in February 2023 and he has been involved in EMC/EMI analysis of medical device implants in occupational and public settings, electromagnetic evaluations of high voltage transmission lines and litigation consulting in medical and electronics industry.

Peer Reviews

International Journal of Hyperthermia

Biomedical Engineering Online

Beilstein Journal of Nanotechnology

IEEE Transactions in Magnetism

ASME Journal of Biomedical Engineering

Molecules (MDPI)

Elsevier Life Sciences

ACS Nano

Cryobiology

Applied Sciences (MDPI)

Medical Physics