

# Nanomaterials for Precision Medicine

**Srinivas Sridhar**

Northeastern University and Harvard Medical School, USA

Corresponding and Presenting Author. E-mail: s.sridhar@northeastern.edu

DOI: 10.5185/vpoam.2021.02133

## Abstract

The modern era of Precision Medicine requires targeted delivery of molecular inhibitors that control key processes in disease pathways. We have developed more than 50 theranostic nanoplatforms that combine multiple functionalities including targeting to the disease site, multi-modal imaging, and delivery of the drug payload through sustained as well as triggered drug release.

PARP (Poly ADP Ribose Polymerase) plays a crucial role in the DNA repair pathways in a cell, rendering it the ‘Achilles Heel’ specifically in cancer cells. We have developed novel *injectable* nanoformulations of PARP inhibitors that have superior bioavailability and tumor accumulation compared with available oral formulations. These results imply an important role for the PARP*i* nanoformulations as chemo and radio-sensitizers enabling mono- and combination nanotherapeutic approaches for ovarian, breast and prostate cancers and sarcomas.

We developed sustained release bioresorbable implants for local chemoradiation therapy. Extensive preclinical studies have shown the very high efficacy accompanied by negligible toxicity in prostate cancer mice models. IND enabling studies are being completed toward a forthcoming Phase I clinical trial.

We have developed a new breakthrough method of quantitative MRI called QUTE-CE MRI using magnetic nanoparticles. QUTE-CE MRI renders vascular images of unprecedented clarity and definition and is further quantitative, transforming MRI from a semi-quantitative imaging modality (camera) to a precision instrument. We have just completed a clinical trial for neuroimaging using this technique at Massachusetts General Hospital.

Supported by the National Science Foundation, National Cancer Institute, National Institute of Aging, AFOSR, DoD CDMRP, Rivkin Foundation and American Lung Association.

## Biography of Presenting Author



**Srinivas Sridhar**, Ph.D. is University Distinguished Professor of Physics, Biomedical Engineering and Chemical Engineering at Northeastern University, and Lecturer on Radiation Oncology, Harvard Medical School. He previously served as Vice Provost for Research at Northeastern University, overseeing the University's research portfolio.

An elected Fellow of the American Physical Society, Sridhar's current areas of research are nanomedicine, neurotechnology and MRI imaging. His paper in *Nature* in 2003 was listed among Breakthroughs of 2003 by the journal *Science*. He has published more than 200 articles on nanomedicine, neurotechnology, nanophotonics, metamaterials, quantum chaos, superconductivity and collective excitations in materials.

As Founding Director of the Electronic Materials Research Institute at Northeastern University, Sridhar established a Nanomedicine Center for synthesis and characterization of nanoparticle formulations. His team has prepared and characterized several nanoplateforms ranging from lipid, polymeric and metallic nanoparticles to implants for sustained release for drug delivery of chemotherapeutics and biologics such as PARP inhibitors and siRNA, for application in cancer, cardiovascular and neurological diseases. With his students he has developed a groundbreaking approach to quantitative MRI that is soon to be tested in patients. An entrepreneur, he has founded companies that are translating his discoveries to the clinic.

Sridhar is passionately committed to training future scientists and engineers and providing access to knowledge to all particularly to those from under-represented minority communities. He has trained more than 120 faculty, postdoctoral fellows, scientists, and graduate and undergraduate students. He is Director of the Nanomedicine Academy funded by grants for NSF and NIH, whose vision is to providing training in nanomedicine nationally and globally. He is Director of CaNCURE: Cancer Nanomedicine Coops for Undergraduate Research, an NIH R25 program to provide research training in cancer nanomedicine. He is Director and PI of the NSF IGERT Nanomedicine Science and Technology Center. He developed several first-of-their kind courses in Nanomedicine. These unique programs have taught hundreds of graduate and undergraduate students in several minority serving institutions and led to institutional change in the form of new programs in nanomedicine. Sridhar's contributions to education and training have been recognized by awards and invitations to speak and to participate in national panels on education.

## Citation of Video Article

Vid. Proc. Adv. Mater., Volume 2, Article ID 2102133 (2021)

**Full Video Article** [www.proceedings.iaamonline.org/article/vpoam-2021-02133](http://www.proceedings.iaamonline.org/article/vpoam-2021-02133)