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UCSD NANOENGINEERING SEMINAR SERIES

WEDNESDAY, JANUARY 11, 2012

11:00 am – 12:00 pm

Fung Auditorium

Synergistic Approaches in Molecular and Nanoscale Therapeutics and Delivery Systems for Cancer Diseases

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Abstract

Cancer diseases place an enormous burden on the human condition. While surgery and radiation therapy are common primary interventions for localized disease, new developments in chemotherapy, gene therapy, immunotherapy, are under investigation in cases of recurrent, aggressive and metastatic disease. The complexity and heterogeneity associated with advanced cancer diseases manifest as multiple resistance mechanisms to treatment. This, in turn, necessitates approaches that act synergistically in order to overcome these resistances, leading to effective cancer cell death. Research in my laboratory involves the discovery and delivery of synergistic treatments for enhancing the efficacy of molecular and nanoscale therapeutics for drug and gene delivery to cancer cells.

Gene therapy involves the administration of genetic material in order to overcome the consequences due to genetic mutations that characterize several diseases, including cancer. Polymers are safer alternatives to viral delivery vectors, but polymer-mediated delivery typically suffers from low efficacies of protein expression. This presentation will describe the synergistic use of combinatorial polymer discovery, investigation of intracellular transport of nanoscale cargo, and modulation of trafficking with anti-cancer chemotherapeutic drugs for enhancing the efficacy of polymer-mediated gene delivery.

We have recently interfaced polymers with gold nanorods (GNRs) in order to generate polymer-GNR assemblies capable of transgene delivery, optical imaging and hyperthermia, all on a single nanoscale platform. I will also briefly introduce our research on gold nanorod-polypeptide based plasmonic 'nanomatrices' which are capable of simultaneously administering hyperthermia and chemotherapeutic drugs for ablation of cancer cells. Finally, I will introduce our work on the discovery and nanoparticle-mediated delivery of clinically relevant chemotherapeutic drug combinations to prostate, breast and pancreatic cancer cells. The use of microfluidic devices in facilitating this drug discovery process will also be briefly mentioned.

Biosketch

Dr. Kaushal Rege is an Assistant Professor of Chemical Engineering and a member of the graduate faculty in the Biomedical Engineering and Biological Design programs at Arizona State University (ASU) in Tempe, AZ. He was recently invited to join the Center for Convergence of Physical Sciences and Cancer Biology (PS-OC) at ASU as a member in 2011.

Dr. Rege graduated with a B.Tech. in Chemical Engineering in 1998 from National Institute of Technology (NIT), Warangal, India. He received his Ph.D. in Chemical Engineering in 2004 from Rensselaer Polytechnic Institute (RPI) in Troy, NY working with Professors Steve Cramer and Jon Dordick. Thereafter, he carried out postdoctoral research at the Center for Engineering in Medicine at Massachusetts General Hospital and Harvard Medical School, in Boston, MA under the mentorship of Professor Martin L. Yarmush. Dr. Rege was awarded a postdoctoral traineeship award from the Prostate Cancer Research Program at the Department of Defense for his postdoctoral research on engineering nanoparticle-peptide assemblies for destruction of prostate cancer cells.

Dr. Rege's research at ASU is primarily in molecular and nanoscale bioengineering with applications in therapeutic discovery and delivery for cancer diseases. He has over forty manuscripts either published or accepted for publication. He was co-editor of a book titled *Methods in Bioengineering: Nanoscale Bioengineering and Nanomedicine*, published by Artech House in 2009 and has co-edited thematic issues for journals. He is an Associate Editor of a new journal Nano LIFE and is on the editorial board of the Journal of Nanomedicine and Nanotechnology. Dr. Rege received a Young Investigator Award from the Defense Threat Reduction Agency (DTRA) and also an Outstanding Faculty Achievement Award in Chemical Engineering from ASU in 2010. Dr. Rege serves as PI on one NIH R01, three NIH R21, two NSF, one DTRA, and one Arizona Biomedical Research Commission (ABRC) awards. His students have won poster awards at the AIChE national conference, and he serves as co-chair of the graduate program in chemical engineering at ASU.