Joint Department of

BIOMEDICAL ENGINEERING

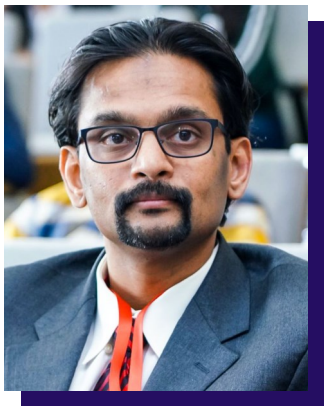
UNC CHAPEL HILL | NC STATE UNIVERSITY

Coulter Seminar Series Presents

"Biomaterials for photothermal tissue repair and healing"

Kaushal Rege, PhD

Fulton Faculty Impact Professor
Chair, Biological Design Graduate Program
Graduate Faculty, Chemical Engineering, Harrington Biomedical Engineering, Biological Design, Materials Science and Engineering, and School of Molecular Sciences
Arizona State University



Dr. Kaushal Rege is Fulton Faculty Impact Professor and Chair of the Biological Design Graduate Program at Arizona State University (ASU) in Tempe, AZ. Research in Dr. Rege's group focuses on molecular and nanoscale technologies for wound healing, tissue repair and therapeutic delivery. Dr. Rege has published approximately 100 journal papers and several book chapters. He is an inventor on several patents and patent applications. Dr. Rege serves as Associate Editor of the journals, Bioengineering and Translational Medicine (Wiley) and NanoLIFE, and has served as Guest Member of the Editorial Board for Annual Reviews in Biomedical Engineering. Dr. Rege was elected to the college of fellows of the American Institute of Medical and Biological Engineers (AIMBE) in 2017. He was awarded a New Investigator Award from the American Society for Photobiology, a Young Investigator Award from the Defense Threat Reduction Agency (DTRA), and a Fulton Exemplar Faculty Award from ASU. Dr. Rege's mentees have gone on to pursue successful careers in academia and industry.

ABSTRACT

Repair of damaged tissues often requires surgical closure of the tissue and skin, which are facilitated by primary intention with devices including sutures and staples. However, lack of immediate tissue approximation, high potential for scarring, including in visible areas of the body, propensity for tissue trauma and infection, and long procedure times necessitate new approaches for tissue repair. Light-activated tissue sealing is an emerging strategy that facilitates rapid fluid-tight approximation of ruptured tissues, but the lack of effective biomaterials compromises efficacy. I will discuss our advances in the generation, characterization, evaluation, and delivery of laser-activated polypeptide biosealants and nanofibers in which, molecular or nanoparticle chromophores are embedded within natural polypeptide matrices and fibers. Irradiation of these biosealants and nanofibers with near infrared light facilitated a photothermal response, which, in turn, engendered rapid, liquid-tight sealing and accelerated repair of soft tissues including skin, intestines, and peripheral nerves, both ex vivo and in live animals. I will also discuss a new approach in which biomaterials alone can be used for simultaneous photothermal conversion of non-ionizing light as well as concomitant tissue sealing, thus dispensing the need of nanoparticles or dyes. In addition to acute trauma, slow-healing and chronic wounds, including in diabetic and obese patients, place an enormous burden on the healthcare system. Advanced treatments, including biologicals, have shown promise but have largely not succeeded in intractable wound pathologies. I will describe our new findings on the delivery of immunomodulating bioactive molecules and polypeptide biomaterials (e.g. silk) in combination with growth factor nanoparticles with an eye towards developing a temporal delivery strategy for specifically modulating individual stages of tissue repair, leading to accelerated healing, including in diabetic and obese mice. Temporal delivery in which bioactives are delivered to modulate individual phases of tissue repair therefore emerges as a promising approach in traumatic injury and chronic pathologies. Taken together, our studies demonstrate that polypeptide biomaterials, in concert with delivery of light, show strong translational promise for accelerating wound healing, and efficacious tissue sealing and repair.

Friday, April 22nd
12:00 Noon

Presented From: 321 MacNider Hall (UNC)
Videoconferenced to: 4142 Engineering Building III (NC State)
& East Carolina University (ECU)