UNIVERSITY OF DELAWARE
ENGINEERING

DEPARTMENT OF BIOMEDICAL ENGINEERING

2019-20 SEMINAR SERIES

KAUSHAL REGE

Professor: Chemical Engineering
Chair: Biological Design Graduate Program

Arizona State University

12-2-19
COLBURN LAB 102
10:00AM

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ABSTRACT:

LIGHT-ACTIVATED POLYPEPTIDE BIOMATERIALS FOR TISSUE SEALING AND REPAIR

Repair of laceration wounds and surgical incisions is facilitated by primary intention devices including sutures and staples, which suffer from 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. 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 and evaluation of laser-activated 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, fluid-tight sealing and accelerated repair of soft tissues both ex vivo and in live animals. I will also discuss our novel strategy in which biomaterials by themselves are 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 wounds, slow-healing and chronic wounds, including in diabetic and obese patients, place an enormous burden on the human condition and healthcare system. Advanced treatments, including biologicals, have shown promise but have largely not succeeded in intractable pathologies likely because of poorer stabilities. I will describe our new findings on the delivery of immune-modulating biactives (e.g. histamine), and polypeptide biomaterials (e.g. silk) in combination with growth factor nanoparticles with an eye towards modulating different stages of tissue repair, in order to accelerate healing. We describe evaluation of these new combination treatments, including using temporal delivery strategies in immunocompetent, and obese, diabetic mice. Taken together, our studies demonstrate that polypeptide biomaterials, in concert with delivery of light, show strong translational promise for accelerating wound healing, and tissue sealing and repair.

BIOGRAPHY:

Dr. Kaushal Rege is a Professor of Chemical Engineering 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 application in light-activated tissue repair, therapeutic delivery and radiotherapy. Dr. Rege has published more than 85 journal papers and several book chapters. He has served as co-editor for two books and for multiple special issues for journals. He is an Associate Editor of two journals, serves as Guest Member of the Editorial Board for Annular Reviews in Biomedical Engineering, and is also an inventor of several patents and patent applications. 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.