SOUTH DAKOTA MINES

Nanoscience and Nanoengineering
Biomedical Engineering
South Dakota School of Mines and Technology
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BioSNTR
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IMPACT SCIENCE

NANO-BME Seminar

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Extracellular Matrix Mimicry towards Craniofacial Tissue Regeneration

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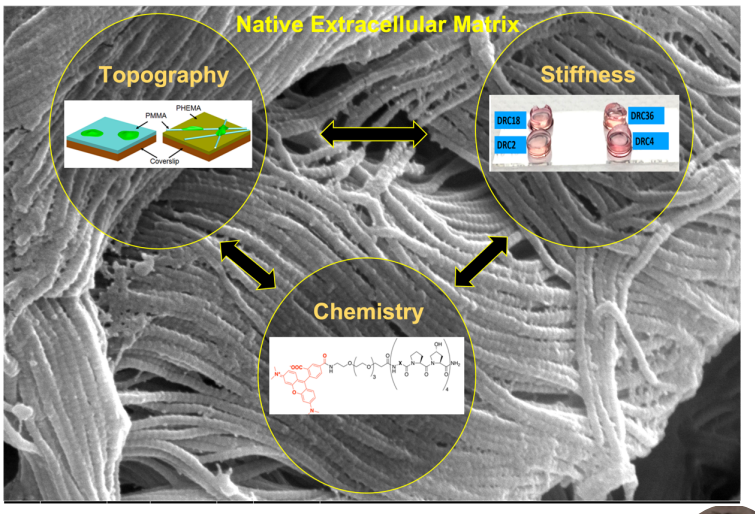
Abstract: Each tissue in the craniofacial region of the human body possesses a unique biochemical architecture defined as extracellular matrix (ECM). During traumatic injury or congenital defects, the ECM is either lost or dysfunctionally organized such that the resident cells cannot perform the desired function. The field of Tissue Regenerative Engineering (TRE) utilizes tools such as biomaterials, stem/progenitor cells, growth stimuli *ex vivo* to capture the functional tissue architecture. Towards the overarching goal of a lab grown tissue, biomaterials hold the key by serving as provisional ECM that controls stem cell differentiation into mature tissue cells. Polymer synthesis, processing and chemical modification can be used to tune physical and chemical properties of biomaterials for TRE. In this talk, I will describe how three important biomaterials design criteria and their functional output is used to develop successful Craniofacial TRE therapies. *Topography:* Utilizing electrospinning of poly(methylmethacrylate) into bone collagen fibril mimetic curved topography, we showed synthetic substrate curvature is necessary for osteoprogenitor differentiation towards mature osteoblasts via intracellular tension for bone tissue regeneration. *Stiffness:* Through modulating the stiffness of 3D synthetic hyaluronic acid-based hydrogels, we controlled the size of 3D spheroid assemblies that are able to secrete amylase for salivary gland regeneration. *Chemistry:* Using non-natural aminoacids mimicking natural collagen, we tuned the size and organization of natural collagen fibrils. The resulting fibrils exhibit resistance to collagenase degradation which further incorporated into therapeutic dressings for diabetic wound healing.



About the speaker: Professor Ozdemir received the PhD in Bioengineering from Penn State in 2013. She was a postdoctoral researcher at the University of Delaware from 2014-2017 and at the University of Pennsylvania from 2019-2020. She has been an Assistant Professor of Biomedical Engineering at South Dakota Mines since 2020, specializing in the development of biomaterials and tissue engineering.