DEPARTMENT OF BIOMEDICAL ENGINEERING

VIRTUAL SOTAK LECTURE

APRIL 16, 2021 **4PM – 5PM** **VIA ZOOM**

USING SECRETS OF THE MAYA TO CONTROL BONE FORMATION

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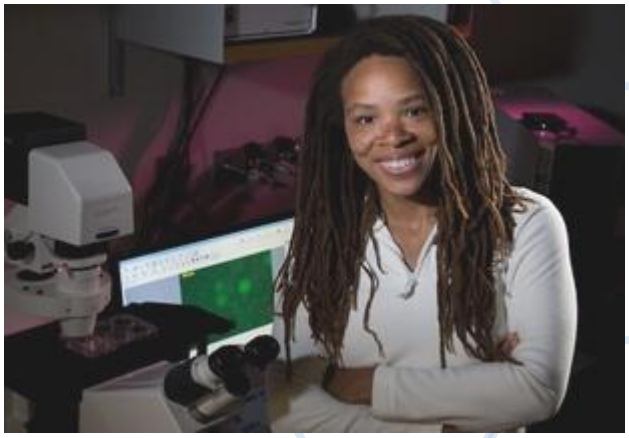

Global increases in life expectancy drive increasing demands for bone regeneration. The gold standard for surgical bone repair is autografting, which enjoys excellent clinical outcomes; however, it possesses significant drawbacks including donor site morbidity and limited availability. Although collagen sponges delivered with bone morphogenetic protein, type 2 (BMP2) are a common alternative or supplement, they do not efficiently retain BMP2, necessitating extremely high doses to elicit bone formation. Hence, reports of BMP2 complications are rising, including cancer promotion and ectopic bone formation, the latter inducing complications such as breathing difficulties and neurologic impairments. Thus, efforts to exert spatial control over bone formation are increasing. Spatiotemporal control over bone formation has yet to be fully achieved, particularly microspatial control. Nacre, also known as mother of pearl, the inner lustrous side of seashells, was used by the Maya as early as the 7th century as the first endosseous bone implant. Recently, nacre has been demonstrated to be osteogenic, biocompatible, biodegradable and non-immunogenic. Comprised of aragonite, nacre attains a strength 3,000 times greater than that of geologic aragonite through precise control of its microarchitecture. By exploiting nacre's microspatial control, we were able to design biomaterials able to precisely control cell-mediated osteogenesis and acellular mineralization. Our results revealed that both PEGylated BMP-2 and nacre proteins showed some ability to direct osteogenesis when patterned onto polyethylene glycol diacrylate (PEGDA) hydrogel substrates. These findings have broad implications on the design and development of orthopaedic interventions and drug delivery.

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