Fall 2022 Special Seminar

Department of Chemistry and Chemical Biology

Professor Susmita Bose

Washington State University

Friday, November 4, 2022

11:30AM-1:00PM—Panel Session w/ Students
On-site—CCB 1203

2:30—4:00PM—Speaker Seminar Presentations
On-site—CCB 1303
Virtual—Zoom*

Host: Professor Kate Waldie

"3D Printing and Natural Medicine for Bone Regeneration: Convergence of Knowledge"

The role of 3D printing (3DP) or additive manufacturing (AM) is becoming essential for patient-matched implants due to better functionalities, lower cost, and shorter lead time to manufacture. Establishing process property relationships for different AM techniques is vital to their successful implementation in biomedical devices, especially for their reproducibility and machine-to-machine part quality variations. AM of multiple materials in a single operation is also an exciting innovation. Inorganic biomaterials, e.g., calcium phosphate (CaP) ceramics being compositionally similar to the inorganic part of the bone, are often used in bone implants as 3DP tissue engineering scaffolds and surface-modified hip and knee implant devices. Dopant chemistry in CaP plays a vital role in controlling their resorption or degradation kinetics as scaffolds, mechanical strength, and biological properties of resorbable CaPs. Bone quality and functionality are crucial in patient-specific defect healing. To shorten the healing time via better osteogenesis and angiogenesis, not only the dopant chemistry but also the use of natural medicinal compounds (NMCs), such as the active compounds of Turmeric (Curcumin), Ginger (Gingerol), Garlic (Allicin), Oregano (Carvacrol/thymol), have shown to accelerate osteogenesis for more rapid bone growth, lessening the time for healing. In 3DP CaP scaffolds, for bone tissue engineering, 3D interconnected channels provide pathways for micronutrient transport and improved mechanical interlocking between scaffolds and surrounding bone. The use of polymer helps in controlling drug release kinetics. In vivo studies show improved osteogenesis, angiogenesis, and controlled drug delivery using NMCs in these 3D-printed scaffolds and coatings. These systems show promise for their use in orthopedic and dental devices while eliminating the need for the autografts and the second site surgery for harvesting, as well as improving current hip/knee implant lifetime .

For Zoom meeting information, please contact Loretta Lupo @ lal275@chem.rutgers.edu

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