CENTER FOR RESEARCH IN SOFT MATTER & POLYMERS

CRiSP SEMINAR

TUESDAY, JAN. 12, 2020

11:00 A.M.

ZOOM WEBINAR

"Polymers and functional graphenic materials as stem cell instructive scaffolds for bone regeneration"

The Sydlik group at Carnegie Mellon uses chemical signals and intelligently designed materials to instruct bone regeneration. To do this, we use polymers and functional graphenic materials (FGMs) to create new biomaterials that offer tunable mechanical properties, degradability, and surface chemistry, which together can be used to control bioactivity. FGMs, are degradable in in vivo, but the application of FGMs as biomaterials have been limited due to insufficient control of the chemical interface and limited processing methods. To address this, the Sydlik group has developed new methods to covalently bind polymers and other biomimetic moieties to the surface of FGMs using classic organic reactions. Using these novel organic transformations, we can impart surface functionalization. This produces FGMs with tunable surface chemistry, allowing installation of cell instructive moieties, and improved mechanical properties arising from graphene reduction. We have developed FGMs that inherently induce osteogenesis in vitro and in vivo. Specifically, our modified Arbuzov reaction couples polyphosphate on the GO backbone with control over a variety of bioinstructive counter ions (Ca^{2+}, K^{+}, Li^{+}, Mg^{2+}, or Na^{+}). Ca^{2+}, Li^{+}, Mg^{2+}, and PO_4^{3-}. These ions are known to be inducerons, or small ions that encourage the osteogeneic differentiation of stem cells. Further, we have shown that calcium phosphate graphene (CaPG) induces osteogenesis in vivo in a mouse model. These materials are designed to degrade in water, and to release signals known to drive regenerative healing in their process of degradation. We have also developed a new class of peptide-graphene covalent conjugate and are working to show that FGMs can serve as intrinsically inductive, autodegradable scaffolds for bone regeneration in vivo.

PROF. STEFANIE SYDLIK, PH.D.

Assistant Professor of Chemistry & Biomedical Engineering (courtesy)

CARNEGIE MELLON UNIVERSITY

Professor Sydlik received her Ph.D. in organic chemistry from the Massachusetts Institute of Technology under the direction of Professor Timothy Swager, studying novel nanocarbon and polymeric materials. She continued her training at MIT as a postdoctoral fellow with Professor Robert Langer, developing a novel biomimetic block copolymer for cartilage repair and establishing the biocompatibility of graphene oxide. Through her training, she received fellowships from the Beckman Foundation, NSF, and NIH. She joined the faculty at Carnegie Mellon University in August of 2015 and has since won the PMSE Young Investigator Award and is a World Economic Forum Young Scientist.

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