

BIOENGINEERING SEMINAR

FALL 2022

**** In-person at SciTech location ****

Injectable Hydrogels for Biomedical Applications

Abstract

Hydrogels are a class of soft biomaterials with broad applications in fundamental and applied research. While photopolymerization reactions are commonly used to synthesize hydrogels, light is required for hydrogels to form thereby limiting their applications to conditions where light is readily available. In this presentation I will discuss the synthesis and characterization of hydrogels that self-form in the absence of light. Stable and enzymatically degradable macromers were modified with norbornene (Nor) or tetrazine (Tet), which upon mixing click into covalently crosslinked Nor-Tet hydrogels. By varying total macromer concentration and ratios, hydrogels were synthesized with tunable stiffness (5 to 30 kPa) and gelation times (1 to 6 minutes). By modifying Nor-containing macromers with methacrylates, thiol-containing peptides were coupled to methacrylates and used to form peptide-functionalized Nor-Tet hydrogels. By changing hydrogel parameters (stiffness, degradation), 2D matrix mechanosensing and 3D spreading of mesenchymal stem cells (MSCs) were controlled. MSCs encapsulated in Nor-Tet hydrogels containing peptides that mimic bone morphogenetic protein-2 (BMP-2) also expressed high levels of bone biomarkers, and injections with BMP-2 hydrogels into medullary cavities induced trabecular bone growth in femurs. The hydrogels presented here feature independently tunable biochemical and mechanical parameters, are biocompatible, and retain their properties *in vivo*.

Biography

Sebastián L. Vega is an Assistant Professor in the Department of Biomedical Engineering at Rowan University. His lab focuses on the design of tunable biomaterials to control cell-material interactions with applications in cell manufacturing and regenerative medicine. Sebastian's research is supported by grants from the NSF, NIH, Camden Health Research Initiative, and Cooper Foundation. Prior to joining Rowan, Sebastian was a postdoctoral researcher in Bioengineering at Penn under the mentorship of Dr. Jason Burdick, where he studied the role of biophysical and biochemical cues on cellular mechanosensing and stem cell differentiation. Sebastian completed two B.S. degrees in Chemical Engineering and Biomedical Engineering at Carnegie Mellon University and received his Ph.D. in Chemical and Biochemical Engineering from Rutgers University. As a Chilean native and first-generation Ph.D. graduate, Sebastian is passionate about initiatives that promote diversity, equity, and inclusion. Sebastian is the Chair of Outreach and Community Engagement in his department and runs in-person and virtual programs that provide regional high school students with opportunities to learn about biomedical engineering and to conduct academic research in engineering labs. To learn more about the lab's work, please follow @theVegaLab on Twitter.



Sebastián Vega, PhD

Assistant Professor, Department of
Biomedical Engineering
Chair of Outreach and Community
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Thursday, September 29th

12:00-1:00 pm

**In-person at SciTech Campus:
Katherine Johnson Hall, Rm 258**

Live streaming to Fairfax
Campus:
Horizon Hall, Rm 1012