



Department of Biomedical Engineering
Graduate Seminar



Dr. Andrés J. García, Ph.D.

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Subject: Bioengineered Synthetic Hydrogels for Regenerative Medicine

Abstract:

Hydrogels, highly hydrated cross-linked polymer networks, have emerged as powerful synthetic analogs of extracellular matrices for basic cell studies as well as promising biomaterials for regenerative medicine applications. A critical advantage of these synthetic matrices over natural networks is that bioactive functionalities, such as cell adhesive sequences and growth factors, can be incorporated in precise densities while the substrate mechanical properties are independently controlled. We have engineered poly(ethylene glycol) [PEG]-maleimide hydrogels for local delivery of therapeutic proteins and cells in several regenerative medicine applications. For example, synthetic hydrogels with optimal biochemical and biophysical properties have been engineered to direct human stem cell-derived intestinal organoid growth and differentiation, and these biomaterials serve as injectable delivery vehicles that promote organoid engraftment and repair of intestinal wounds. In another application, hydrogels presenting immunomodulatory proteins induce immune acceptance of allogeneic pancreatic islets and reverse hyperglycemia in models of type 1 diabetes. Finally, injectable hydrogels delivering anti-microbial proteins eradicate bone-associated bacterial infections and support bone repair. These studies establish these biofunctional hydrogels as promising platforms for basic science studies and biomaterial carriers for cell delivery, engraftment and enhanced tissue repair.

Bio:

Dr. Andrés J. García is the Parker H. Petit Chair and Executive Director of the Petit Institute for Bioengineering and Bioscience. He is a Regents' professor in Georgia Tech's Woodruff School of Mechanical Engineering. He received a B.S. in Mechanical Engineering with Honors from Cornell University in 1991. He received M.S.E. (1992) and Ph.D. (1996) degrees in Bioengineering from the University of Pennsylvania. He completed a two-year post-doctoral fellowship in cell and molecular biology at the School of Medicine of the University of Pennsylvania. Dr. García's research program centers on integrating innovative engineering, materials science, and cell biology concepts and technologies to generate (i) novel insights into the regulation of adhesive forces and mechanotransduction, and (ii) cell-instructive materials for tissue repair in regenerative medicine.

applications. His research has received funding from the NIH, NSF, Coulter Foundation, Arthritis Foundation and Juvenile Diabetes Research Foundation. He has received several distinctions, including the NSF CAREER Award, Arthritis Investigator Award, Georgia Tech's CETL/BP Junior Faculty Teaching Excellence Award, Young Investigator Award from the Society for Biomaterials, Georgia Tech's Outstanding Interdisciplinary Activities Award, and the Clemson Award for Basic Science from the Society for Biomaterials. He serves on the editorial board of leading biomaterial and regenerative medicine journals.

He has been recognized as a top Latino educator by the Society of Hispanic Professional Engineers. He has been elected a Fellow of Biomaterials Science and Engineering by the International Union of Societies of Biomaterials Science and Engineering, AIMBE, and AAAS.

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