REGENERON WESEF 2019
The Westchester Science & Engineering Fair

Finalist: **Jainil Sutaria, Rachel Lee, Chelsea Wang**

School: **Ardsley High School, Spackenkill HS, Fossil Ridge HS**

Title: Synthesizing and Characterizing Novel Gelatin and Pluronic® F127 Hybrid Hydrogels as a Barrier Membrane for Guided Bone Regeneration Following Periodontitis

Abstract:

Periodontitis is the inflammation of gingival tissue and a proponent of bone loss. Guided bone regeneration (GBR) separates gingival tissue from bone using a barrier membrane to allow osteoblast regeneration and is the most effective treatment in restoring bone tissue to prevent tooth loss; however some current barriers have poor mechanical strength and cytotoxicity. In this study, we synthesized novel hybrid hydrogels composed of gelatin and Pluronic® F127 with improved mechanical strength and evaluated their performance in vitro as a potential GBR membrane barrier layer. Rheological analysis of the hybrid hydrogels revealed an almost five-fold increase in elastic modulus compared to the pure gelatin hydrogel. We propose that the substantial improvement in mechanical strength can be attributed to three factors: 1) F127 packed into the gelatin mesh allows the network to resist deformation; 2) hydrogen bonding between the hydrophilic PEO blocks of F127 and gelatin strengthen the mesh network; 3) physical crosslinking of F127 due to entanglement of polymer chains further strengthens the gel. We also demonstrated that the mechanical properties of the hybrid gels can be tuned by adjusting the concentration ratio of gelatin to F127. Fourier transform infrared spectroscopy confirmed the hybrid composition of the gels and the presence of gelatin-F127 physical interactions. Confocal microscopy performed on the hybrid gels plated with human dermal fibroblasts (HDFs) revealed significantly reduced cell attachment and proliferation compared to the pure gelatin hydrogel. 3D reconstruction from confocal image data confirms that hybrid gels remained impermeable to cells. Our findings suggest that gelatin-F127 hybrid hydrogels are promising biomaterials for application as a GBR barrier membrane for periodontitis treatment.