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Engineering Aligned, Bioactive Polymers for Peripheral Nerve Repair

Peripheral nerve injuries impact 1.4 million Americans each year with over 20 million people living with the effects of traumatic nerve injuries. In severe peripheral nerve injuries, nerve pathways, connections, and the extracellular matrix that lead to sensory or motor targets are disrupted. If the injury gap is over approximately 2 centimeters, functional recovery is extremely limited. This deeply impacts subsequent quality of life due to the loss of connections between the central nervous system and the body's extremities. One primary reason for poor functional recoveries is that neurons do not have the proper guidance and signaling from the damaged extracellular matrix to allow targeted growth across the injured tissue. This project will address the urgent need to engineer bioactive materials to guide nerve regeneration to promote functional recoveries in traumatic nerve injuries. This will be accomplished by engineering polymers to possess the proper physical and chemical signals in order to direct cell and extracellular matrix alignment and growth. We will micropattern polymers to give alignment and combine the micropatterned polymers with a natural, extracellular matrix to facilitate regeneration and guidance of nerve. It is hypothesized that a bioactive, aligned polymer will functionally bridge the injury gap and guide neurons along scaffolds to restore function to the injured tissue.

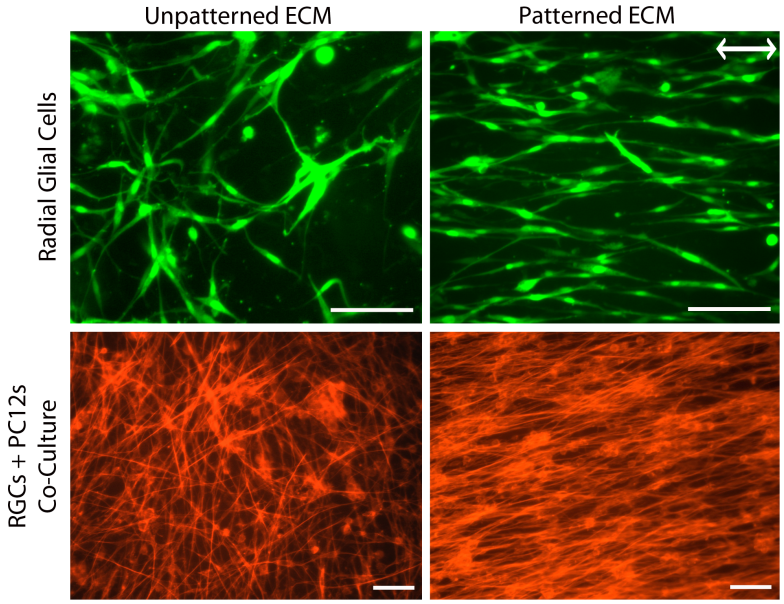

Figure 1: (Top row) Radial glial cells (RGCs) were seeded onto unpatterned or patterned extracellular matrix on biomaterials, grown for 2 days, and imaged. (Bottom row) RGCs were seeded and grown for 2 days on unpatterned or patterned extracellular matrix and at 2 days PC12 (mimics neuronal cell) cells were seeded onto RGCs and extracellular matrix. Cells were grown together for an additional 3 days and imaged to assess alignment of cells and processes.