Objective

• Design, synthesize, and characterize materials for interfacing prosthetic devices with living tissues
• Enable the next generation of artificial limbs to have better biological integration, and the ability to provide motor control and receive sensory feedback

Objective Approach

• Establish stable, functioning biotic-abiotic living interfaces with motor and sensory peripheral nerves
• Functionalize and segment abiotic material connection with peripheral nerve
• Enable stable biotic-abiotic connections between skin and bone

Status

• Successful stable, functional biosynthetic interface with motor and sensory peripheral nerve fibers
• Successful stable neuromuscular junctions
• Mechanical bone-frame interface optimized
• Peripheral nerve growth in presence of PEDOT coating
Progress on prior year’s objectives
– Cultured myoblasts implanted in vivo as part of a living interface show maturation and innervation by severed peripheral nerve fibers
– Motor action potentials recorded in living interface
– Sensory feedback to living interface verified
– Peripheral nerve growth in the presence of polymer coated scaffolds demonstrated
– Bone-frame interface for controlled loading implanted in canines

Research plan for the next 12 months
– Functional characteristics of PEDOT-coated neural interfaces for in vivo muscle and peripheral nerve recording during recovery from injury
– Electroconductive Polymer Sensor Interrogation System (EPSIS) consisting of a transducer array with a conducting polymer coating combined with the living tissue interface (myoblasts) for implantation and coaptation with severed peripheral nerve.
– Quantitatively evaluate interface between a porous metal insert and regenerating trabecular bone including use of engineered and biological coatings
– Direct integration of engineered coating materials into skin

Long term objectives (demonstrations)
– Materials for stable, functional interfaces between prosthetics and tissues
– Development of functional interfaces which enhance prosthesis performance capabilities, given the incorporation of engineered materials