The Future of Prosthesis: The Design and Production of a Neural Prosthetic Comprised of Ionic Polymer-Metal Composites

McDonald, Sydney

In the United States alone, there is an amputee population of over two million people. Despite this, prosthetics are immensely expensive, costing up to seventy thousand dollars for the most advanced designs, and are not covered by health insurance. This project examines ionic polymer metal composites (IPMC), and takes advantage of the contraction of IPMCs in response to an electric charge, which in turn produces another charge, allowing a flow of electricity and series of contractions. By layering pieces of IPMC and bonding them together, the project aims to design & analyze an artificial muscle which can be used to build a neural prosthetic for a lesser cost, that lasts a longer period of time, and can handle stress, strain, or contamination; thus, one that can be used in everyday life.The IPMC muscle showed high potential for strain, high stress, and, as a result, a low modulus of elasticity, but high power potential. Using the mathematical models generated by the physical analysis of the properties of the IPMC, a prototype prosthetic was designed and built. These results indicate that the IPMC would be ideal for building a neural prosthesis, and is capable of providing feedback from the electrical impulses generated by the IPMC in response to an outside charge.