An ‘Unusual’ Story: The Biology Meets Its Match

Multifunctional sensing capability, ‘unusual’ formats with flexible/stretchable designs, lightweight construction and self-powered operation are desired attributes for electronics that directly interface with the human body. Today’s electronics are stiffer by up to six orders of magnitude compared to soft tissue. Thus, present systems limit intimate integration with biology. I have focused on novel microfabrication techniques and tricks to use active piezoelectric materials and required electronic components, which have the shape and the mechanical properties that match with those of human tissues, in order to allow intimate integration without any irritation and/or harm on body.

In this talk, I describe novel materials, mechanics and device designs for emerging classes of wearable health monitoring systems and implantable, minimally invasive medical devices. These include a variety of electrodes, sensors, and energy harvesting components, with promising applications in bio-integrated electronics, such as self-powered cardiac pacemakers, wearable blood pressure sensors, modulus sensor patches, and brain injectrodes. The devices can be twisted, folded, stretched/flexed and wrapped onto curvilinear surfaces or implanted without damage or significant alteration in operation. The fabrication strategies and design concepts can be applied to various biological substrates and geometries of interest, and thus have the potential to broadly bridge the gap that exists between rigid, boxy electronics and soft, curvy biology.