Soft, Skin-Interfaced Systems for Sweat Collection, Physiological Monitoring, and Biochemical Sensing

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Abstract: Unusual classes of electronics and microfluidics enabled by recent advances in materials science and mechanics can be designed with physical properties that approach the mechanical properties of human skin. These systems are referred to as epidermal electronics and epifluidics by virtue of their stretchable form factors and soft mechanics compared to conventional packaged electronics and sensors. In this talk, I present an overview of recent advances in novel materials, mechanics, and designs for emerging classes of fully-integrated epidermal electronics and soft microfluidic systems. These devices incorporate microfabricated arrays of sensors, microfluidic channels and biochemical assays, configured in ultrathin, stretchable formats for continuous monitoring of kinematics, cardiac, mechano-acoustic, neuromuscular, and electro-chemical signals. Quantitative analyses of strain distributions and circuit performances under mechanical stress highlight the utility of these wearable systems in the clinical and home environments. I will conclude with representative examples of these epidermal devices, which began as feasibility projects in research publications a few years ago, and have now entered the commercialization phase with leading industrial partners.

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