ENGINEERING INSPIRED BY BIOLOGY

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Biological systems and physiological processes have evolved over millions of years to have precise properties and functions. Today, engineers have an appreciation for the sophistication of biological systems, and they look to these for inspiration in the rational design of materials and systems. By studying and mimicking complex biological structures and processes, materials and devices can be designed with novel features and enhanced properties to provide solutions to problems in a wide variety of disciplines from healthcare to small-scale electromechanical devices. This session aims to highlight bio-inspired, biomimetic, or bio-derived technologies and innovation, as well as the future outlook of the field. The key connecting thread among these talks is the diverse role biology is playing in contemporary engineering. Bio-derived or bio-inspired technologies as well as biological molecules are pivotal to novel engineering solutions in a number of fields.

A revolution in healthcare is expected in the near future when low cost genome sequencing for individuals becomes a reality. Our first talk will highlight the engineering challenges in the analysis of genetic variation, gene expression, and function. This involves mimicking and exploiting biological recognition and/or function with detection at high fidelity. For example, single nucleotide discrimination through nanopores can occur under an applied field, which is a mimic of the highly versatile ion channel. The challenges are many, but the benefits will be tremendous in determining mechanisms of disease, drug candidates, and clinical molecular diagnostics. It will lead to faster screening and detection of disease as well as the tailoring of therapeutics based on an individual's genetic predisposition toward disease, or personalized medicine with individualized therapeutics. Inherent within these developments will be efficiently and effectively delivering therapeutics to the patient. Thus, our next talk will focus on controlled and targeted drug delivery, specifically using biology in the design of targeted therapeutics. Getting the optimal amount of therapeutic to the right place at the right time is a significant goal of the advanced drug delivery field. Finally, the capstone talk will involve using biomolecules for actuation as motor powered devices within systems, whether the system is the cell itself, or using biomolecules to provide an actuation mechanism on a micro/nano-electromechanical (MEMS/NEMS) device.