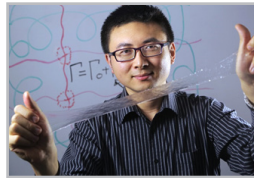




announcing

Mechanical Engineering Lecture in  
Mechanics

## Soft Living Materials and Machines: From Theory to Design



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Massachusetts Institute of Technology*

**Friday December 2, 4:00PM, 3-270**

Nature designs a vast library of soft materials to constitute most machineries of living bodies. Soft living materials possess a set of attributes – such as high compliance, resilience, robustness, and capabilities of sensing, responding and self-healing – unattainable in conventional engineering materials. For example, articular cartilage, a natural hydrogel that contains 70% water, can maintain impressively high fracture toughness under millions of cycles of loads. Skeletal muscles can achieve high actuation stress, strain and energy efficiency, yet operating over years. Mussel secretes soft glues to form extremely robust adhesions to rocks and metals in flowing water with high salinity. What are nature's strategies in designing various soft living materials? How to fabricate soft materials that possess properties and functions as living organisms? Can we integrate soft living and engineered machines to create new forms of machines or life?

These questions have fostered a nascent field that not only advances fundamental knowledge in mechanics and materials but also impacts on our society's grand challenges in health, food, water and joy of living. In this talk, I will show that unconventional polymer network architectures represent a general strategy to design soft living materials with extraordinary properties. Guided by our theory, I will demonstrate the design of synthetic cartilages, artificial muscles, and mussel-inspired glues with world-record performances. I will then introduce a general method based on our 3D bio-printing system to integrate soft materials, living cells with sensors, actuators and computer chips for systematic design of various soft living machines. The interplays between theory, experiments and design will be emphasized throughout the talk.