香港大學 機械工程系
Department of Mechanical Engineering
THE UNIVERSITY OF HONG KONG

# SEMINAR

## Engineering Robotic Skin and Muscle: Materials and Strategies for Next-Generation Biorobotics

**Date:** 5 August, 2026 (Wednesday)
**Time:** 11:00 a.m.
**Venue:** Room 7-34 & 7-35
Haking Wong Building
HKU

**Speaker:** Professor Yu Jun Tan
Department of Mechanical Engineering
National University of Singapore
Singapore

**Abstract:**
Biological organisms outperform today's robots in adaptability, resilience, and sustainability. Muscles generate efficient movement, skin senses the environment, detects damage, and heals after injury. Living systems continuously recycle their materials through natural life cycles. Reproducing these capabilities remains one of the grand challenges in biorobotics.

In this talk, I will present our group's research on engineering robotic skin and muscle through advanced materials and bioinspired design strategies. I will first introduce multifunctional self-healing materials that enable robotic skins to achieve tactile sensing, damage detection, and autonomous recovery, allowing them to maintain functionality even after severe mechanical damage. I will then discuss our efforts toward sustainable robotics through biodegradable electronic materials derived from renewable biomaterials, demonstrating how circular-material strategies can reduce electronic waste. I will then present our work on energy-efficient light-emitting devices, including low-voltage electrochemiluminescent devices and self-powered mechanoluminescent photonic skins that provide intuitive visual outputs for wearable electronics, soft robots, and underwater robotic systems.

I will also describe our recent work on harnessing living materials as biological actuators for biohybrid robots. Here, we used engineered skeletal muscles. By developing autonomous muscle-training strategies, we have enhanced muscle performance and demonstrated muscle-powered robots with record-breaking locomotion capabilities. These studies highlight how advances in materials science, soft electronics, and bioengineering are bringing us closer to a new generation of robots that not only move like living organisms but also sense, heal, communicate, and ultimately incorporate living tissues as functional components.

**Reference:**
A Self-Healing Magnetoelectric Sensor with Pain Sensing for Underwater Soft Electronics. *Advanced Materials* **38**, e202523052 (2026).

Ionic liquid–regulated interfacial charge transport and asymmetric device architecture for high-performance electrochemiluminescence. *Science Advances* 12,eaed9796 (2026).

3D Printing of Auxetic Self-powered Mechanoluminescent Photonic Skins for Underwater Communication and Safety Monitoring. *Advanced Materials* **37,** 2502743 (2025)

Fast-swimming biohybrid OstraBot with self-trained high-strength muscles. *Nature Communications* **17**, 2246 (2026).

**Biography:**

Yu Jun Tan (National University of Singapore, NUS) is an Assistant Professor in the Department of Mechanical Engineering, where she is a PI at both the NUS Centre for Additive Manufacturing (AM.NUS) and the Advanced Robotics Centre (ARC).

Dr. Tan's research integrates materials science, mechanics, and bioengineering to develop next-generation bio-derived, bioinspired and biohybrid materials for biorobotics. Her group investigates the processing, deformation, and functional behaviours of soft materials (such as bio-based polymers, gels, and living tissues) with particular emphasis on self-healing, electro-mechanical behaviours, and large-deformation mechanics. By linking fundamentals with sustainable design, her work advances the development of adaptive, self-powered, and eco-responsible machines.

She has published over 40 peer-reviewed papers in top-tier journals, including Nature Materials, Nature Electronics, Nature Communications, Science Robotics, Science Advances, and Advanced Materials. Her publications have been featured on journal covers and highlighted in the media. She is a recipient of the MIT Technology Review's "Innovators Under 35" Asia Pacific 2021 (Pioneer), MRS postdoctoral award, and Science, She Say! Award.

**ALL INTERESTED ARE WELCOME**
**For further information, please contact Professor Philip Chow at 3917 7905.**