Material and Bio-Interface Design Toward Biomedical Applications

*Yiliang Lin**

Department of Chemical and Biomolecular Engineering, National University of Singapore, Singapore, Singapore
* Corresponding author: y.lin@nus.edu.sg

Interfacial interactions are at the heart of all biological processes. Ideal bio-interfaces would enhance signal transduction through optimized interactions between biomaterials and cells. With the increased capability to manipulate matter at different length scales, new bio-interface materials are being developed through different material selections and designs. In this talk, I will share some of our efforts on the material and bio-interface for biomedical applications. I will highlight our research on the tissue-like material design with both extra-cellular matrix and cell-like building block to endow dynamic properties, such as mechanical responsiveness, ultra-stretchability, viscoelasticity, and self-healing properties. By integrating biodegradable polymers and surface modifications, we've shown how this tissue-like system can be effectively applied in regenerative medicine for treating ulcerative colitis and healing skin wounds, as well as serving as the interfacial materials for bioelectronics[1]. Additionally, I will discuss our latest exploration into soil-inspired chemical systems that utilize a multiscale integration of soft and hard materials to create a responsive matrix. This matrix not only boosts microbial growth in vitro but also has the potential to regulate the gut microbiome in vivo for therapeutic purposes[2]. These rational material and bio-interface studies will help develop multiscale materials to meet emerging needs, from the human-machine interface in telemedicine to biomedical therapy.

References

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