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|  |  | הטכניון - מכון טכנולוגי לישראל  TECHNION - ISRAEL INSTITUTE OF TECHNOLOGY |
| הפקולטה להנדסה כימית  ע"ש וולפסון |  |  |
| The Wolfson Department of Chemical Engineering |  |  |

**Wolfson Department of Chemical Engineering Seminar**

**Monday, April 8th, 2024 at 14:30**

**Room 1**

**Development and Study of Multifunctional Hydrogels for Biomedical Applications**

**Qi Wu**

**PhD mid-seminar**

Advisor: Asst. Prof. Shady Farah

Department of Chemical Engineering, Technion-Israel Institute for Technology

Repair, regeneration, and replacement are common strategies for injured, diseased, and failed tissue/organs. Hydrogels with tunable tissue and extracellular matrix (ECM)-like features considered the most promising biomaterials in various biomedical and clinical applications, as carriers to release drugs, as scaffolds to regenerate cells and tissues, and as dressings to promote infected wound healing. In our first project, we designed and dug for functional and mechanistic studies of several tissue-like bioactive hydrogels, with tunable mechanical performance and rapid self-healing behavior. As-prepared hydrogels have no significant cytotoxicity against several mice and human cell lines and good human-blood compatibility. Besides structural mechanism study via DFT calculation, MD simulation, and rheology, we further explored their antibacterial activity and inherent mechanism by employing extensive MD simulation and fluorescence-based experimental assays. *In vitro* wound healing study and 3D-printability indicated their potential for promoting bacterial-infected wound healing and as carriers for drug delivery. In our second project, we developed several natural-derived bioactive hydrogels consisting of tannic acid and amino acids via ultra-fast in-situ formation and/or 3D printing. These hydrogels exhibited excellent antibacterial, antioxidant, and adhesive properties, which could perform underwater/wet tissue adhesion, such as skin, bone, liver, heart, and kidney. *Ex-vivo* studies proved their potential for sealing of air-leaking lung and blood-leaking brain. Moreover, *in vitro* cell culture indicated these hydrogels are highly compatible with mice fibroblast cells in direct-contact model, and provided a favorable matrix for cell adhesion and proliferation. In our current project, we are focusing on the systematic study of positive amino acids-based bioactive hydrogels, including chemical modifications, physical properties, and biological activities highly related to cell culture.