Globular Proteins From Our Body Toward Advanced Functional Biomaterials

Dr. Luai R. Khoury
Department of Materials Science and Engineering, Technion Israel Institute of Technology, Haifa, 32000, Israel

Proteins are remarkable machines in our body and are responsible for many essential processes. They have unique natural properties that no other macromolecules in nature have. These nano-machines are inherently biocompatible, chemically, and biologically diverse, and can be smartly responsive to various external triggers.

Combining all these properties will expand the toolbox for designing new innovative, responsive protein-based materials, which can be translated into various bio-applications, such as drug delivery systems, soft medical devices, and many more. However, the mission is not that straightforward, a high protein concentration is needed (> 2 mM) to form a material, but proteins are not that abundant and tend to aggregate, making the protein-based materials synthesis and characterization cumbersome. In addition, the protein-based materials are very soft, and the characterization methods in our labs do not fit the requirements. Moreover, protein-based materials are way behind polymer materials, even though proteins are way more developed than polymers.

During my talk, I will introduce new approaches to overcome the challenges in the field; and how using unique proteins' characteristics can bring protein-based materials to the forefront of the biomaterials field.

Furthermore, I will introduce a new method that confers protein-based hydrogels with tunable mechanical behavior and microstructure morphology by controlling the material's crosslinking density while preserving protein folding transitions and concentration. Finally, I will present the recent progress in my team projects for using proteins in designing advanced functional biomaterials.