

Advanced Soft Functional Biomaterials for Biomedical Applications

Abstract

Soft materials (softmatters) such as hydrogels are an important class of biomaterials that have several biomedical and pharmaceutical applications in drug and cell delivery, tissue engineering, three-dimensional (3D) printing, and more recently in sensing and actuating applications. To date, many smart softmatters have been developed and tested in vitro and in animals. However, they are still associated with limitations and faced many challenges especially with their mechanical and physicochemical characteristics. To solve these problems, a multidisciplinary approach is required to expedite the biomedical application of these exciting materials.

In this talk, I will present my research journey from the chemistry to engineering where I employed soft functional biomaterials for advanced biomedical engineering applications, such as treating various diseases ranging from cancer to cardiovascular diseases. Among the various functional biomaterials, the focus of my research has been initially on catechol-containing biomaterials. Catechol groups are a fascinating class of ligands that can act as antioxidant agents and chelating agents in coordination chemistry for binding to metal ions. They can also be used as crosslinking mediators in constructing the hydrogel network and also participate in various intermolecular and surface interactions. In this presentation, I will first elucidate how catechol containing biomaterials can be used to produce smart self-healing, adhesive and elastic soft biomaterials and how this class of soft biomaterials may pave the way towards accelerated tissue repair and developing advanced drug delivery systems. In the second part of my presentation, I will discuss how microengineering soft biomaterials such as Hyaluronic acid (HA) (a natural polysaccharide commonly found in our bodies), has enabled us to develop a novel hydrogel-based microneedle patch device that automatically senses blood glucose level and delivers glucagon (blood glucose-raising hormone), to prevent hypoglycemia, one of the dangerous side effect of insulin injection. Finally, I will discuss the future prospective of soft functional biomaterials for use in the next generation of biomedical devices.

Biography

Dr. Amin GhavamiNejad is a postdoctoral research associate, instructor and seminar coordinator at Leslie Dan faculty of pharmacy, University of Toronto (UofT). He received his Ph.D. degree in Chemical Engineering (with a minor in Biomedical Engineering) from the Chonbuk National University (CBNU), South Korea in 2014. Prior to joining UofT, he was a research assistant professor in Mechanical Design Engineering Department at CBNU (South Korea). He has an extensive research experience in synthesizing biomaterials and engineering biomedical devices for various biomedical and pharmaceutical applications. He is one of the recipients of the Banting & Best Diabetes Centre Fellowship in Diabetes Care and has also obtained and supervised several projects funded by various federal and provincial funding agencies in South Korea and Canada.