Professor Maynard received a Bachelor of Science degree with Honors in chemistry from the University of North Carolina at Chapel Hill, and a doctorate in chemistry from the California Institute of Technology in 2000. She then moved to the Swiss Federal Institute of Technology in Zurich (ETH), where she was an American Cancer Society Post-doctoral Fellow from 2000-02. Maynard joined the University of California, Los Angeles (UCLA), faculty as an assistant professor in August 2002, as the first Howard Reiss Career Development Chair in the Department of Chemistry and Biochemistry and as a member of the California NanoSystems Institute. She is now a full professor and the Myung Ki Hong Endowed Chair in Polymer Science, director of the Chemistry Biology Interface Training Program and associate director of Technology and Development for the California NanoSystems Institute. Maynard's research interests focus on the design and synthesis of biomimetic and biohybrid polymers and hydrogels for applications in protein drug stabilization and delivery.

Fluorous, Trehalose and PEG Containing Degradable Polymers and Nanoparticles for Medical and Agricultural Applications

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Functional synthetic polymers and nanoparticles are important in a variety of fields. For many applications, controlled degradation is desirable or even necessary to fulfill design requirements. This talk will focus on three classes of degradable polymers and nanoparticles that we have developed for different applications. The first class is based on polymers where the backbone degradability is controlled by fluorous side chain content. Specifically, we synthesized copolymers containing poly(ethylene glycol methyl ether methacrylate) (PEGMA), fluorous methacrylate (1H,1H,2H,2H-perfluorooctyl or 1H,1H,2H,2H,3H,3H-perfluoropentyl methacrylate), and the cyclic ketene acetal 5,6-benzo-2-methylene-1,3-dioxepane (BMDO) by controlled radical polymerization. The polymers assembled into single-chain nanoparticles or multi-chain nanoparticles depending on the fluorous content. The fluorous content also controlled the degradation rate of the nanoparticles; specifically, the degradation rate constant for the highest fluorous content polymer was one hundred-fold smaller compared to the non-fluorous polymer. This was shown by spectroscopic data to be due to the local environment rather than the self assembled structures themselves. Thus, fluorous content is an excellent way to control degradation of nanoparticles based on poly(PEGMA). The second class of polymers and nanoparticles is based on trehalose glycopolymers. Specifically, polyesters with side chain trehalose and trehalose glycopolymers containing pendant pyridyl disulfide groups were synthesized. The former stabilize an important therapeutic granulocyte colony-stimulating factor (GCSF) and degrade by hydrolysis. The latter polymers were subsequently cross-linked into nanoparticles utilizing the important hypoglycemia therapeutic peptide glucagon, which was modified to contain two free thiols. As a result, the peptide loading content was high, the peptide was bioactive in vitro, and it was readily released in reducing environments. Most importantly, the trehalose glycopolymer nanoparticle protected the glucagon from aggregation for at least three weeks and also to neutral pH, while the native peptide aggregates within hours under these conditions. The third class of nanoparticles is based on poly(ethylene glycol) (PEG) and cross-linking is accomplished utilizing oxime and hydrazone chemistries. Depending on the imine chemistry utilized, the degradation of hydrogels and nanoparticle can be controlled. These materials are being utilized to incorporate chemicals for agricultural applications for controlled delivery. This talk will cover in detail the synthesis of the various polymers, the formation of nanoparticles, characterization and degradation. In addition, applications specifically in medicine and agriculture will be disclosed.

Host: Keun-young "Kevin" Park
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