Synthetic Polypeptides Prepared by Ring-Opening Polymerization of *N*-Carboxyanhydrides

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Synthetic polypeptides are biodegradable and biocompatible polymers with high potential for the use in broad range of biomedical applications. Ring-opening polymerization (ROP) of *N*-carboxyanhdride monomers, prepared from α-amino acids bearing various hydrophobic or hydrophilic side chains, results in synthetic polypeptides with controlled molar mass characteristics and chain-end fidelity, which enable the preparation of block-copolymers as well as polymers with complex macromolecular architectures. Since the propagation during ROP proceeds through the amine end-groups, the primary amines are most commonly used initiators. In this presentation, a new approach in which the hydroxyl groups act as initiator sites will be presented. For this purpose the initiation and the propagation steps were successively carried out by using an acid/base catalytic system. This approach not only expands the pool of possible initiators, but also significantly facilities the preparation of polypeptide hybrid materials. Some examples on adjusting the properties of synthetic polypeptides for specific biomedical applications using various post-polymerization modifications to prepare amphiphilic anionic or cationic polypeptides will be additionally discussed. Amphiphilic anionic polypeptides based on poly(L-glutamic acid) were used together with the chitosan derivative for polyelectrolyte complexation with protein drug to prepare the protein-polymer nanoparticles as drug-delivery systems, whereas amphiphilic polycationic polypeptides based on poly(L-lysine) showed excellent antibacterial activity versus specific bacterial types.