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Mucus permeating nanocarriers for the oral delivery of biomolecules

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Macromolecular drugs have the unique ability to tackle challenging diseases but their structure, physicochemical properties, stability, pharmacodynamics and pharmacokinetics place stringent demands on the way they are delivered to a specific site/tissue in the body. At present, protein drugs are usually administered parenterally, but this route is less desirable and posess problems of oscillating blood drug concentrations. Moreover, their short biological half-lives necessitate in some cases multiple injections per week causing considerable discomfort to the patients. Nanocarrier-based drug delivery systems can diminish the toxicity of biomolecules, improve their bioavailability and make possible their administration via less-invasive routes. To date various types of nanocarriers have been developed for the oral administration of biopharmaceutics. Apart from oral vaccines which target Peyer's patches that are not covered by a mucus gel layer, nanocarriers have to permeate the mucus gel barrier in order to reach the epithelium. More specifically, an ideal nanocarrier should exhibit an enhanced permeation rate through the mucus gel layer thus allowing the delivery of the therapeutic payload to the epithelium. Additionally, it should exhibit a sustained drug release profile and sufficient protection towards enzymatic degradation of the drug, thus, resulting in increased bioavailability of biomolecules. In this paper, state-of-the-art mucus permeating nanocarriers for controlled delivery of biomolecules are presented and critically assessed (e.g., self-emulsifying drug delivery systems, polyelectrolyte complexes, anionic lipid emulsions, etc.). The nanocarriers were characterized with respect to physicochemical properties, protein loading and release, permeation through fresh porcine intestinal mucus and ability to protect drugs from enzymatic degradation.

Biography

Costas Kiparissides is a full time Professor of Chemical Engineering Department (AUTH) since 1981. He was Director of CPERI (2001-2006) and CERTH (2005-2010). He received his diploma in Chemical Engineering from NTUA (1971) and his PhD from McMaster University (1978). He has supervised more than 50 PhD students, 160 diploma theses and has presented more than 300 invited seminars and lectures. He has published 210 papers in refereed journals, 430 conference papers and 24 books and reports. His research interests include advanced multi-scale modeling of chemical and biological systems, functional materials, drug delivery systems, and microbial production of functional biopolymers.

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