Continence Project

Bioactive Biomaterials and Infection Control – Uroglide Coatings

Funded by Invest NI and the Royal Academy of Engineering

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Description of Research

Our research is focussed on the development of bioactive biomaterials for medical device applications. One example concerns the development of photoactive biomaterials for the prevention of medical device-related infection. These are designed with surface-localised photo-sensitisers which generate highly reactive oxygen species (ROS) following irradiation. The ROS are highly cytotoxic towards a range of bacteria, viruses and fungi, thus ensuring surface disinfection. This patented strategy has been successfully applied to ophthalmic and urological medical devices.

We are also active in the development of triggered drug delivery approaches using stimuli such as light and pH.

Light-activated delivery of a wide range of therapeutic agents has been achieved from photo-responsive polymers following irradiation with a defined wavelength of light. This technology has been applied to ocular biomaterials and endotracheal tubes. PH has been exploited as a trigger by two main mechanisms. Firstly, with the use of pH-responsive ionisable polymers which swell upon changes in pH to release their drug load and, secondly, through the synthesis of cleavable drug conjugates, which provides a greater degree of control over release. One of the major applications of this pH-responsive research has been in the development of infection-resistant urinary biomaterials exploiting the elevation in urinary pH reported at the onset of catheter-associated urinary infections due to urease-producing bacteria.

A further strand of research has focussed on the development of a lubricious coating technology, Uroglide, for intermittent self-catheterisation products to ease catheter insertion and removal, and reduce the associated complications of infection, bleeding and urethral damage.

Methodologies

Formulation; synthesis of labile drug conjugates; development of light-triggered drug delivery systems; drug release (kinetic and thermodynamic) studies; bacterial adherence studies; coefficient of friction measurements etc.

Key Results

Development of:

•Lubricious coatings with reduced friction, increased durability and extended dry-out time.

•Photoactive biomaterials which generate highly reactive oxygen species upon irradiation to ensure surface disinfection.

•Triggered drug delivery approaches using stimuli such as light and pH to achieve responsive delivery of a wide range of therapeutic agents from bioactive biomaterials for medical device applications.

Links to Published Papers

http://dx.doi.org/10.1111/jam.12241;http://dx.doi.org/10.1007/s11095-012-0927-x;
http://dx.doi.org/10.1016/j.tetlet.2013.03.020;http://dx.doi.org/10.1517/17425247.2015.962512;
http://dx.doi.org/10.1371/journal.pone.0108500

Link to Website

http://www.uroglide.com