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OPTICS & PHOTONICS
UNIVERSITY OF NOTTINGHAM

Optics and Photonics Group
Lunchtime Seminar

"Needle-free drug delivery across epithelial barrier"

Kevin Webb

"Needle-free drug delivery across epithelial barriers"

Many drugs must currently be injected
No-one likes a needle in their eye
We may have a needle-free solution!

13:30 Wednesday 19 April 2023
C24 Coates building
All Welcome

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https://optics.eee.nottingham.ac.uk/wiki/Seminars_2022-2023

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MS Teams link

The need: One of the commonest causes of a drug not working is failure to reach its target. The body consists of compartments separated by tissue barriers. These barriers are formed by sheets of cells joined by tight junctions. They are essential for health but can block drug access. A current example of this problem occurs in the treatment of age-related macular degeneration (AMD). There are very effective new drugs, but they are blocked by these tissue barriers. They have to be injected into the eye. It is desirable to be able to deliver such drugs without injections. This would increase patients' quality of life while reducing both hospitals visits and costs. These problems are common and occur for many other conditions in other tissues (e.g. lungs, gut, brain, skin, testes), including some cancers.

A general solution: Our solution opens the tight junctions between barrier-forming cells in a reversible manner. This allows us to "open the door" to let drugs in and then "close the door" afterwards. We have used human cell lines to identify 18 effective agents. We have demonstrated that this works in eyes in a pair of animal studies. We successfully delivered drugs using eyedrops that would normally need to be injected. We observed no signs of toxicity. This novel, needle-free way to deliver these particular drugs will reduce costs, dosages, and discomfort in treating AMD. It will also reduce the number of hospital visits. This will benefit both patients and health systems. We can apply our novel platform technology to any tissue to deliver, in principle, any drug. We have filed patent on this technology. Application space Our technology has a role in drug delivery wherever there is a tissue barrier. Monoclonal antibodies all biodistribute much the same, and most drugs smaller in size (150kDa). Botox, as one example, is also 150kDa in size. Reversible disruption of barrier function at the body surface may also prove helpful enhancing electrical recordings from the body, and in sampling tissue fluids for diagnostic purposes. It may even provide needle-free ink delivery to agriculture and the tattoo industry. We have proof of concept in porcine skin indicating potential applicability across these applications. We have shown that our technology is effective in delivering both siRNA and monoclonal antibodies across human primary lung epithelial cells under air-liquid-interface culture in vitro.

Opportunity: Our platform technology can be applied by non-skilled personnel, and requires no special equipment, providing at-home delivery formulations for medicines that currently require a hospital visit to receive.