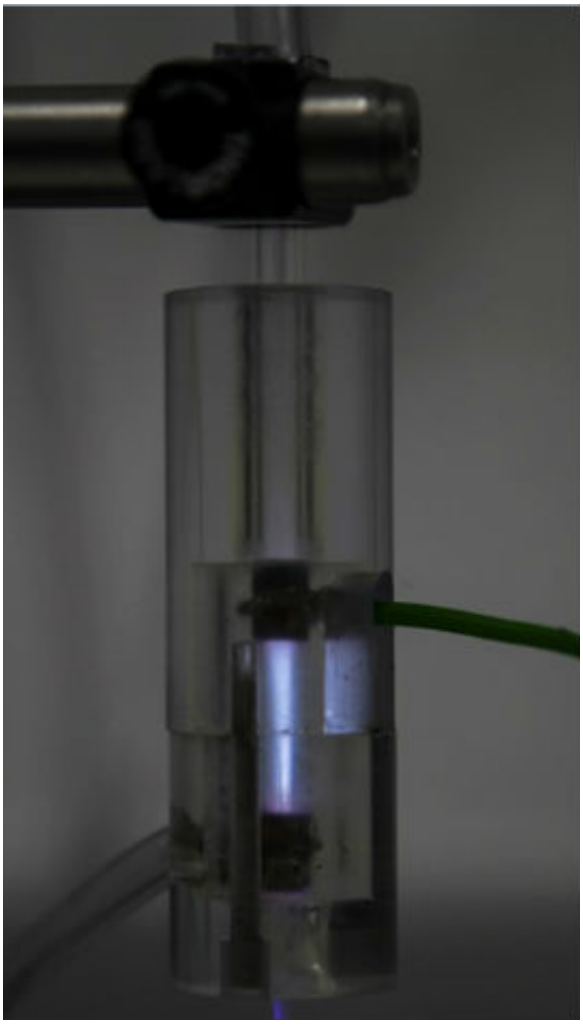
Researchers study new treatment for prostate cancer

April 9 2015



Scientists at the University of York have discovered a potential new treatment for prostate cancer using low temperature plasmas (LTPs).

Published in the *British Journal of Cancer* (BJC), the study is the first time LTPs have been applied on cells grown directly from patient tissue samples. It is the result of a unique collaboration between the York Plasma Institute in the Department of Physics and the Cancer Research Unit (CRU) in York's Department of Biology.

Taking both healthy prostate cells and prostate cancer tissue cells from a single patient, the study allowed for direct comparison of the effectiveness of the treatment. Scientists discovered that LTPs may be a potential option for treatment of patients with organ confined prostate cancer, and a viable, more cost-effective alternative to current radiotherapy and photodynamic therapy (PDT) treatments.

Low temperature plasmas are formed by applying a high electric field across a gas using an electrode, which breaks down the gas to form plasma. This creates a complex, unique reactive environment containing high concentrations of reactive oxygen and nitrogen species (RONS).

Operated at atmospheric pressure and around room temperature, the delivery of RONS, when transferred through plasma to a target source, is a key mediator of oxidative damage and cell death in biological systems.

The way cell death occurs when using LTP treatment is different from other therapies. The active agents in the LTP break up DNA and destroy cells by necrosis, where cell membranes are ruptured, resulting in cell death. This is different to some current therapies which cause apoptosis, where cells are prompted to die through natural mechanisms that can result in treatment resistance.

Adam Hirst, a PhD student at the York Plasma Institute who has been

working with Dr Fiona Frame on the project, said: "Despite continual improvement and refinement, long term treatment for prostate cancer is still recognised as inadequate. In the case of early stage organ confined tumours, patients may be treated with a focal therapy, for example cryotherapy, photodynamic therapy, or radiotherapy.

"However, around a third of patients will experience recurrence of their disease following radiotherapy. This may be due to the inherent radio-resistance of a small fraction of the tumour – the cancer stem-like cells. Furthermore, numerous side effects are often experienced following treatment.

"Through this research we have found that LTPs induce high levels of DNA damage, which leads in turn to a substantial reduction in colony forming ability, and ultimately necrotic cell death. Using clinically relevant, close-to-patient samples, we have presented the first experimental evidence promoting the potential of LTP as a future focal cancer therapy treatment for patients with early stage prostate cancer."

The next step in developing this treatment will see scientists trial this method on three-dimensional replica tumours, monitoring the precision of plasma application. If all subsequent trials are successful, LTP could be used to treat cancer patients within 10-15 years.

More information: "Low-temperature plasma treatment induces DNA damage leading to necrotic cell death in primary prostate epithelial cells" *British Journal of Cancer* advance online publication 2 April 2015; DOI: 10.1038/bjc.2015.113

Provided by University of York