CAMBRIDGE | Enterprise

Implantable drug delivery device targeting brain tumours

Available Technologies

Implantable electrophoretic pump-based device

to treat difficult-to-reach solid tumours through the dry delivery of charged drugs

Successful treatment of brain cancers is limited due to the difficulty of delivering therapies to difficult-to-access tumours. There is also a need for new technologies able to deliver high concentrations of therapeutic to brain solid tumours without causing pressure damage to the brain.

There are 11.000 new brain tumour cases per year in the UK, of which only 12% of patients survive for five or more years after diagnosis.

Background

Standard treatment consists of chemotherapy, radiotherapy and, if possible, surgical resection. Chemotherapy has several limitations: (a) accessibility is limited due to the blood-brain-barrier and bad vascularisation of solid brain tumours and (b) the off-target toxicity.

Several approaches have been proposed to try to overcome those limitations, such as localised drug delivery with convection enhanced delivery. However, this technique has the drawback of creating local high pressures that can trigger drug reflux and pressure oedema (the build-up of fluid in the brain). Another alternative is localised traditional iontophoresis, which involves the dry delivery of a drug with negligible pressure increase. The drawback is the

formation of large amounts of gas and pH drift, which leads to the corrosion of the devices and tissue damage. Further, the electrodes used in these devices have a limited lifetime. The current invention featuring an implantable electrophoretic pump circumvents all of these drawbacks.

Technology overview

The combination of new materials, design strategies and fabrication techniques has allowed the creation of a drug delivery device that solves the accessibility and safety problems to deliver drugs to hard-to-reach brain tumours.

We have invented an implantable iontophoretic device capable of delivering therapeutics across the blood-brain barrier by charge repulsion. A redox-active solution can be continuously supplied into the device, separated from the active drug substrate by an ion exchange membrane. The charged drug ions are then repelled across the blood-brain barrier with negligible increase in local pressure.

Benefits

- No gas formation or pH drift
- Delivery of a high concentration of charged molecules into the brain
- Prevents delivery of redox molecule and electrochemical reactions of the drug at the electrode
- Negligible local pressure increase
- Modulation of the dosing regimen and the delivery rate tailored to the profile of the therapeutic compound
- Can sense and monitor informative parameters
- Adaptable for other types of solid tumours
- Can run as long as the redox solution is continuously supplied

Application

The technology can be used as an implantable device to deliver chemotherapy and electrical therapies to treat hard-to-reach solid tumours. Currently, the invention is adapted to the brain tumour field, but it can be adapted to other tumour types.

Opportunity

We are looking for a collaborative partner to develop and commercialise the technology. We are exploring both company formation or licensing to an existing company as potential commercialisation strategies.

Inventors

Tobias Naegele

Professor George Malliaras

Professor Ulrich F Keyser

Patents

- European Patent Application number 22386080.0 was filed on the 11th November 2022