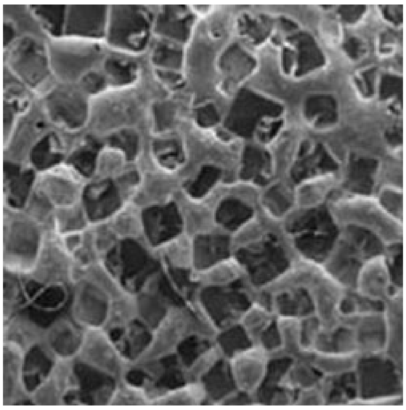
Liquid biomaterials take stem cell therapy to new level

Scientists at the forefront of stem cell biology are exploring new approaches to creating surgical implants that could offer prolonged benefits for sufferers of osteoarthritis and potentially even cancer.



A scanning electron microscope photograph of the surface of a macroporous elastomer, a type of polymer. Full control of the elastomer pore size allows the release of a wide range of therapeutic agents ranging from pharmaceutical chemicals to therapeutic stem cells. (Image: Dr Husam Younis, Qatar University)

At present, cartilage implants created using stem cells can only be constructed as a solid shape, acting as an interim measure before the almost inevitable need for total joint replacement.

Now researchers at the University of Bristol are investigating the possibilities of a biologically-engineered synthetic liquid polymer that would eliminate the need for further surgery by offering a one stop, permanent solution.

Could this be the next breakthrough?

Dr Wael Kafienah, from Bristol's School of Medical Sciences, believes this research could represent the next breakthrough in stem cell therapy. He and his team are collaborating with researchers in Canada and Qatar to explore how such a biomaterial could be created. Dr Kafienah, the lead Principal Investigator for Bristol, has been funded by the Qatar National Research Fund (QNRP), with approximately $1 million over a period of three years to conduct the initial research. The QNRP has an international annual cycle of highly competitive, peer-reviewed, collaborative funding.

If the research proves successful, clinical trials could be carried out within five years.

Initial research shows that an injectable gel would have the capacity to form three-dimensional scaffolds that could be moulded to assume the solid form of even an irregularly shaped defected area, resulting in the formation of new tissue that would fully fill the defect at the point of delivery and encourage the growth of healthy cells.

Poymer-cell constructs can be used to create cartilage implants that can grow at the defect site

A gel-based biomaterial could also be used for immunotherapy, where stem cells injected into the body would stimulate the immune system to destroy the tumour by providing a source of gene therapies or therapeutic vaccines. Injecting these stem cells in the form of a gel would allow clinicians to target the tumour through a prolonged, controlled release of the therapeutic proteins required, with obvious benefits to the patient as there would be fewer courses of treatment.

Dr Kafienah said: "The versatility of injectable polymers and stem cells opens up endless opportunities for cell-based therapies. For instance, the polymer-cell constructs can be used to create cartilage implants that can grow at the defect site without the need for the expensive process of growing the tissue in the lab before hand. The technology can also aid bone fracture repair where the presence of stem cells is shown to enhance bone repair capacity but require a flexible vehicle to sustain their delivery. There is a rapidly expanding area of regenerative medicine that is hugely dependent on injectable biomaterials. The novel biomaterials we are working on would be ideal for this, given what we anticipate to be their superior mechanical properties and cell guiding chemistry."

The research builds on the advances already made by Bristol's team of stem cell and tissue engineering experts in creating cartilage from adult human bone marrow stem cells, coupled with the work of researchers at Memorial University of Newfoundland in Canada and Qatar University in creating novel injectable biomaterials for cartilage tissue engineering.

Source: Bristol University