Taking tissue regeneration beyond the state-of-the-art

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The University of Nottingham has begun the search for a new class of injectable materials that will stimulate stem cells to regenerate damaged tissue in degenerative and age related disorders of the bone, muscle and heart.

The work, which is currently at the experimental stage, could lead to treatments for diseases that currently have no cure. The aim is to produce radical new treatments that will reduce the need for invasive surgery, optimise recovery and reduce the risk of undesirable scar tissue.

The research, which brings together expertise in The University of Nottingham's Malaysia Campus (UNMC) and UK campus, is part of the Rational Bioactive Materials Design for Tissue Generation project (Biodesign). This €11m EU funded research project which involves 21 research teams from across Europe is made up of leading experts in degenerative disease and regenerative medicine.

Kevin Shakesheff, Professor of Advanced Drug Delivery and Tissue Engineering and Head of the School of Pharmacy, said: "This research heralds a step-change in approaches to tissue regeneration. Current biomaterials are poorly suited to the needs of tissue engineering and regenerative medicine. The aim of Biodesign is to develop new materials and medicines that will stimulate tissue regeneration rather than wait for the body to start the process itself. The aim is to fabricate advanced biomaterials that match the basic structure of each tissue so the cells can take over the recovery process themselves."

More effective and affordable treatments

The demand for organ transplants is great, but there are few donors and transplant rejection remains an ever present concern. This has led to the development of an interdisciplinary research field called "regenerative medicine." Researchers within this field are not only looking to help patients requiring organ transplants, but also those with severe burns, muscle injuries, cardiovascular problems or patients with broken bones that are not healing.

In general, the body's wound repair process works in much the same way regardless of what the condition is or which organ is affected. For instance; the sequence of events that follows a heart attack is similar to the process that takes place following spinal-cord injury. The aim of regenerative medicine is to create a 'seed bed' from which tissue can grow. This technique will lead to more effective and affordable treatments for diseases such as cancer and osteoporosis and for patients who have suffered a heart attack or experienced major trauma.

Nanotechnology for drug delivery

Nottingham and UNMC are developing a new class of injectable material that stimulates stem cells to form new blood vessels, heart and bone tissue.

For more information go to: http://tiny.cc/BioDesign

Professor Shakesheff said: "Biodesign brings together some of the best research groups in Europe to develop new therapies that regenerate human tissue. The opportunity to extend the work through links with our Malaysia Campus opens new opportunities to make an impact on the development of regenerative medicine in the Far East."

UNMC is building on its expertise in nanotechnology for drug delivery. Dr Andrew Morris, an expert in transdermal drug delivery at UNMC, said: "Our understanding of genomics and tissue regeneration means that medicines of the future will be much smarter. We are moving away from simple drugs being given to a patient in a tablet and hoping that they will have the desired effect. Here in Malaysia we are looking at synthesising microparticles which can potentially be injected directly into a patient at the site of injury to promote tissue re-growth. These microparticles would act as a scaffold to encourage regrowth in bone tissue, skeletal muscle and potentially even cardiac muscle."

Dr Nashiru Billa, an expert in drug delivery in the School of Pharmacy, said: "This research is going to have a significant impact on patients. The data obtained so far is quite promising. In future you could include in the delivery system anti-cancer drugs that would not only lead to the growth of the tissue but would also help kill the cancer cells within the bone tissue."

International research involving scientists and students

The Biodesign research also offers exciting opportunities for The University of Nottingham's UK based 4th year undergraduate Pharmacy students. Students registered in the UK are going out to Malaysia to complete their final year research projects. They will be carrying out some of the important early stage synthesis work and producing the microparticles.

Dr Morris said: "The undergraduates are the PhD students, the lecturers and professors of the future. From this early stage work we hope to get publications from this and we hope to see their names on the front of the article at the end of the project."

The EU research funding for this project is another significant milestone for the growth of research activity at UNMC. Professor Stephen Doughty, Vice-Provost for Teaching and Learning at UNMC and a member of the Biodesign team said "It is very pleasing once again to see major research grants awarded to top quality researchers at UNMC and to see the full international potential of The University of Nottingham being harnessed in this way."

Provided by University of Nottingham