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ARC Centre of Excellence for Electromaterials Science

MEDIA RELEASE
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ACES researchers one step closer to new therapy to treat diabetes

3D-bioprinted shells could be the key to successfully transplanting islet cells to treat Type 1 diabetes.

In a new study, recently published in Advanced Healthcare Materials, researchers from the ARC Centre of Excellence for Electromaterials Science (ACES) at the University of Wollongong in conjunction with Royal Adelaide Hospital (RAH) have demonstrated a breakthrough in 3D bioprinting insulin-producing islet cells to overcome some of the critical limitations in current cell transplantation.

While pancreatic islet cell transplantations have become a promising treatment for Type 1 diabetes, there can be poor cell survival rates due to insufficient revascularisation of cells post-transplantation. This new approach has the potential to restore circulation to the area more effectively and to protect the implanted material from immune reactions.

Central to this work are the cutting-edge biomedical printing device, 3D PICT, and customised bioink formulation both designed and built by ACES researchers to support the study. The customised 3D bioprinter and bioink has allowed the team at Royal Adelaide Hospital under the guidance of Prof Toby Coates to fabricate with precise control 3D islet-containing structures with a unique shell layer. This 'Trojan horse' style printing process allows the islets to be delivered into the body in a way that protects and maintains the viability of the cells.

RAH Director of Kidney and Islet Transplantation, Professor Toby Coates said this breakthrough research could revolutionise treatment for people living with Type 1 Diabetes.

"The novel bioprinting process offered with the 3D PICT and designer bioink formulation allows us to use the patient's own cells to create the 3D printed islet structure, meaning we are minimising the distance between each islet to ensure better circulation of nutrients and oxygen, and ultimately reducing the likelihood of rejection in the person's body."

"The next step is to conduct in-depth animal trials, as well as further optimise the bioink formulation to ensure the islets are preserved after encapsulation and transplantation."

ACES Director Prof Gordon Wallace said this latest breakthrough in research is part of the Centre's expanding collaborative clinical research network to explore and capitalise on opportunities for customised 3D bioprinters and bioink formulations.

"We have a vision to utilise our fundamental research in materials science and create tailored solutions to address specific, medical challenges. The rapid advances in our work with the Royal Adelaide Hospital to utilise 3D bioprinting to deliver customised biological results is testament to the importance of this growing area of research," Prof Wallace said.

3D Bioprinting: The Next Generation

Prof Wallace highlighted that breakthroughs like this latest islet cell treatment for diabetes are directly linked to the emergence of the multidisciplinary area of 3D bioprinting.

"We are in the midst of a revolution in science and technology, where the idea of a 3D printed body part is now becoming a very real possibility," Prof Wallace said.

"We are potentially only a few years away from major hospitals being fitted out with 3D printing capabilities that can transform medical procedures, and we need to train the next generation of researchers and engineers to support this burgeoning industry."

3D bioprinting is a rapidly growing area that draws on the skills from a range of fields including science, health, engineering and technology.

ACES and UOW are making it possible for anyone to learn about 3D bioprinting through a Massive Open Online Course (MOOC) Bioprinting: 3D Printing Body Parts. The 10th run of the 3D bioprinting MOOC will start on Monday 28 January, with more than 27,000 learners from 145 countries enrolling in the course since it was launched in 2015.

UOW also offers a Graduate Certificate in Biofabrication, a practical online course designed for professionals currently working in the fields of science, health, engineering and technology, as well as those who want to pursue a career in biofabrication.

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Media opportunity:

Please contact ACES Communication and Media Coordinator Lauren Hood on 02 4221 5306 or lhood@uow.edu.au to arrange any interviews.

About Diabetes

Diabetes is a condition where the body is unable to maintain healthy levels of glucose in the blood. Insulin is essential for converting glucose into energy in the body, however for diabetics, insulin is not produced in sufficient amounts which can lead to a number of short term and long term health complications.

The blood glucose level of Type 1 diabetes patients can be managed via daily insulin injections, however hyper- and hypoglycaemia condition is a common side effect which can lead to irreversible tissue and organ damage and life-threatening comas.

The ARC Centre of Excellence for Electromaterials Science (ACES)

ACES continues to advance cutting edge electromaterials science through the discovery of new materials, technology breakthroughs and 3D fabrication machinery to enhance the performance of electrochemical devices for our applications in energy, robotics, medical bionics and diagnostics.