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Liver bioengineering

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Liver transplantation is presently the only proven therapy able to extend survival for end-stage liver disease. It is also the only treatment for severe acute liver failure and to some forms of inborn errors of metabolism. Nevertheless, the waiting list for liver transplantation is long and many patients will not survive long enough to receive an organ due to the dramatic shortage of donors or lack of eligibility. This distressing donor shortage is also common to other solid organs like the lungs, heart and kidneys.

In light of the grim situation of liver organ transplantation, our laboratory has recently developed a method to generate an entire liver organ scaffold from whole animal livers, using tissue decellularization that preserves the organ's vascular network. This same method, is also able to decellularize other solid organs generating specific acellular kidney, lung, intestine, pancreas or heart scaffolds. Our subsequent studies showed the possibility to efficiently re-cellularize the liver bioscaffolds by perfusing them with human fetal liver progenitor and endothelial cells in a perfusion bioreactor. The outcome was a bioengineered human liver.

The bioengineered human liver organoids displayed typical hepatic phenotypic markers and bile ducts, and some vital human liver functions, such as drug metabolism, protein synthesis and catabolism. These results demonstrate the feasibility of generating bioengineered human liver organoids using acellular organ scaffolds and primary human cells. Altogether, this technology has the potential to create bioengineered organs, critical for stem cell and developmental biology, drug discovery and toxicology, and ultimately, transplantation and treatment of terminal diseases.

Biography

Pedro Baptista is a research fellow at the Wake Forest Institute for Regenerative Medicine in Winston-Salem, NC, USA. His main research interest is in liver organ bioengineering and regeneration. From his work, resulted the development of the first human liver ever made in a laboratory, impacting the scientific community at large and widely broadcasted in the media all around the world. His current research interests focus on investigating liver stem cell biology and the development of novel methods to expand fetal and adult human stem cells to the required numbers necessary for organ bioengineering. He is also interested in applying bioengineered organs to study developmental biology, physiology and drug discovery.

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