A Method for Rapid Generation of Many Different Branched Epithelial Proto-Organs

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BACKGROUND

Currently, patients suffering from diseased and injured organs can be treated with transplanted organs; however, there is a severe shortage of donor organs. In the United States alone, more than 114,000 people are on transplant waiting lists and have a probability of less than 35 percent of receiving an organ transplant within five years of being added to the list. Many of the organs in question are branched epithelial organs. Tissue engineering has long held promise for building new organs to functional replace the ones in patients with organ injuries or end-stage organ failure. However, one major obstacle that remains is the construction of complex 3D functional vascularized epithelial tissues (e.g. lung, kidney, pancreas with both exocrine and endocrine function, breast, and salivary gland, prostate). Many solutions have been proposed, including bioprinting and assembly of cells around extracellular scaffolds of existing organs, but the complex three-dimensional physiology of branched organs cannot be reproduced. Importantly, a very promising area of organ-tissue engineering is the production of vascularized proto-organs or biological tissues to analyze organ toxicity from drugs and environmental toxins. Engineered tissues may offer more accurate predictions of the side effects of potential therapeutic agents because they contain human cells.

TECHNOLOGY DESCRIPTION

Researchers at the University of California have developed a novel tissue engineering strategy that takes advantage of the "biological power" inherent in the process of branching morphogenesis. This novel strategy has a very promising potential to create, at "will," a huge number of distinct 3D functional and vascularize-able epithelial proto-organs (e.g. lung, pancreas, kidney, salivary gland, and breast) using a very straightforward protocol and with a relatively "simple" set-up. These proto-organs are expected to have appropriate 3D spatial relations and differentiation, be capable of getting vascularized and be implantable. They also could be partly or wholly derived from an individual's own cells (e.g. iPS, bone marrow, cord blood, placental or other cells).

APPLICATIONS

Although, the invention is still in the developmental stage, a proto-kidney capable of vascularization and drug transport has been produced using embryonic tissues and embryonic kidney-derived cells, and a protocol that can potentially utilize patient-derived cells is being demonstrated. The invention could be used to generate vascularized proto-organs to substitute for failure of organ. These proto-organs could be implanted during the "process" of organ failure, to improve the organ functionality and reduce the demand of donor's organs. They also could be used in premature infants with immature organs (especially lungs and kidneys) to help maintain the dysfunctional organ until it matures. Finally, the proto-organs could be used as a medium throughput assay to analyze organ toxicity from drugs and environmental toxins, thereby radically diminishing the need for *in vivo* animal studies and increasing the likelihood of success in clinical trials.

RELATED MATERIALS

- Nigam, S. K. Concise Review: Can the Intrinsic Power of Branching Morphogenesis Be Used for Engineering Epithelial Tissues and Organs? Stem Cells Trans Med. December 2013 vol. 2 no. 12 993-1000

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OTHER INFORMATION

CATEGORIZED AS

- **Medical**
  - Disease: Kidneys and Genito-Urinary System

RELATED CASES

2013-084-0

ADDITIONAL TECHNOLOGIES BY THESE INVENTORS

- Method for Engineering Functional 3-Dimensional Kidney Tissue
- Methods of Tissue Repair, Regeneration, and Tissue Engineered Compositions

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