Non-Confidential Description - PSU No. 4547
“Pancreas Model on a Chip for Type-1 Diabetes Drug Testing”

Field of Invention/Keywords:
Diagnostic, drug testing, pancreas, 3D printing

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Background
Type-1 diabetes (TD1) is a devastating disease caused by a significant loss in insulin production by the beta-cells of the pancreas. It is a chronic disease that often leads to severe complications including blindness, limb amputations, kidney failure, neuropathy, and cardiovascular diseases. T1D is currently managed by insulin injections, but new treatments/cures are in development that will require proper testing.

Current pancreas models used in drug testing are limited to mouse models, which do not fully represent the complex biology of their human counterparts. Human models have been difficult to assemble due to the limited number of pancreatic islets and the limited viability of beta cells outside of the body. An alternative model with lasting properties is needed that can be used for efficient TD1 drug testing as well as general study of the endocrine pancreas.

Invention Description
This technology describes a chip that can be used to evaluate pancreatic function and response to TD1 pharmaceuticals. The chip acts as a perfusable human pancreas model with embedded vascularization. The design includes a microfluidics chamber, a bioprinted extracellular matrix, and adipose-derived stem cells directed towards a beta-cell fate. A lumen is formed within the extracellular matrix, which can be perfused with cells, culture media, or other perfusate. This “organ on a chip” recreates the key features of a pancreatic microenvironment and can be used for screening drugs that regulate pancreatic function.

Advantages/Applications
- Real-time observation of cell morphology and drug response
- Keeps tissue intact for testing various TD1 drugs
- Capable of long-term perfusion (up to 26 days)
- First successful culture of pancreatic islets in a 3D vascularized form
- First successful 3D bioprinting system for pancreatic islets

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June 29, 2017