Insulin Producing Cells from Pluripotent Stem Cells

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Technology description

Reverses Diabetes in Mice

A simple, robust and scalable method of directed differentiation of human pluripotent stem cells, including embryonic stem (hES) cells and induced pluripotent stem (iPS) cells, generates insulin-producing cells in vitro that have reversed diabetes in vivo and in diabetic mice. A simple, broadly applicable four-step process demonstrates that hES and human iPS cells from dermal fibroblast cells generate insulin-producing cells. Insulin expression and secretion was detected from iPS-derived cells in vitro and in vivo by qPCR, and c-peptide release was confirmed by immunostaining. These results suggest that the method is robust enough to work with a range of cell types, meaning that iPS cells derived from diabetic patient somatic cells are not only a potential, but a highly attractive, source of cells for transplantation. The technology may also work using individual donor cell lines, making both autologous and allogeneic transplantation therapies possible.

Simpler, More Productive Method to Derive Insulin Secreting Cells

Previous attempts at deriving insulin-secreting cells are not optimal: They are complex, complicated, multiple-step processes involving many added cytokines and growth factors as well as the toxic chemical cyclopamine. These methods also lack significant expansion of cell numbers. Islet replacement therapy is promising but suffers from limited availability of donor tissues. This method requires only four steps, uses a limited number of growth factors, and achieves similar results using a monoclonal antibody instead of toxic chemicals. Furthermore, it achieves expansion of cells during the process.

Application area

Reversing/treating Types 1 and 2 diabetes
Generating therapies that provide sufficient islet replacement cells
Investigating causes of type 1 diabetes
Diabetic patients who suffer from frequent hypoglycemia
Patients with loss of detectable serum c-peptide and/or the complete loss of endogenous insulin
If anti-rejection medication could be reduced or excluded, may be used on children
Potential applications using cells that secrete factors into circulation (e.g., clotting factors for hemophilia, erythropoietin for kidney failure, and hematopoietic factors for neutropenic patients) and for patients receiving marrow-ablative chemotherapy

Advantages

Simple, robust and scalable
Generates insulin-producing cells in vitro
Shown to reverse diabetes in diabetic mice
Only four steps
Uses fewer cytokines than other protocols
Uses a monoclonal antibody; no cyclopamine toxicity
Opens possibilities for both autologous and allogeneic transplantation therapies

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