Discovery may lead to development of cell-based regenerative therapy to restore thyroid function

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A discovery made by investigators from Beth Israel Deaconess Medical Center (BIDMC) and the Boston University School of Medicine (BUSM) may help lead to the development of a cell-based regenerative therapy which could be used to restore thyroid function in patients with cancer who have had their thyroids surgically removed and children born with congenital hypothyroidism. The new findings are described in the October 22 issue of *Cell Stem Cell.*

"This research represents an important step toward the goal of being able to better treat thyroid diseases and being able to permanently rescue thyroid function through the transplantation of a patient's own engineered pluripotent stem cells," explained co-corresponding author Anthony N. Hollenberg, MD, Chief of the Division of Endocrinology, Diabetes and Metabolism at BIDMC and Professor of Medicine at Harvard Medical School.

"Until now, we haven't fully understood the natural process that underlies early thyroid development," said co-corresponding author Darrell N. Kotton, MD, Director of the Center for Regenerative Medicine (CReM) at BUSM and Boston Medical Center and Professor of Medicine and Pathology at BUSM. "With this paper, we've identified the signaling pathways in thyroid cells that regulate their differentiation, the process by which unspecialized stem cells give rise to specialized cells during early fetal development."

After deciphering this natural differentiation process, the investigators duplicated it in the laboratory dish by adding a sequence of proteins, called growth factors, to the fluid bathing the stem cells. The team then used murine pluripotent stem cells to regenerate thyroid function in a murine model of hypothyroidism. Next, they adapted this method using induced pluripotent stem cells (iPSCs) engineered from children with congenital hypothyroidism, who are born with genetic defects that prevent their thyroids from fully developing.

Hypothyroidism results when the thyroid gland produces too little thyroid hormone, which impairs metabolism and can result in slowed heart rate, weight gain and chronic symptoms of feeling cold and tired with decreased mental acuity. Although drugs are available to replace thyroid function, with this new discovery, "we can now envision that thyroid function could be restored by transplanting patients' own thyroid cells," said Hollenberg and Kotton.

This study was made possible through the collaboration of multiple teams of investigators from across North America. In particular, the co-first authors and co-senior authors worked together closely for several years. The two teams came together in the pursuit of new knowledge and patient-oriented treatments; they became close friends as they struggled to support each other through the tragic loss of co-first author, Anita Kurmann, MD, who died this summer in a biking accident.

Source:
Beth Israel Deaconess Medical Center
