Researchers grow pituitary glands from embryonic stem cells

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(Medical Xpress) -- A new study published in *Nature* reports that scientists have been able to grow working pituitary glands from embryonic stem cells from mice. When these were transplanted into mice with defects in the pituitary gland, the levels of hormones missing in the body were raised.

The pituitary gland is a pea-sized endocrine gland at the base of the brain and secretes different hormones including Human Growth Hormone, or HGH and thyroid-stimulating hormone, or TSH. The release of these hormones plays a role in things such as growth, blood pressure, pregnancy and thyroid function. Inadequate release of certain hormones by the pituitary gland can lead to various hormone disorders.

The team of researchers, led by Dr. Yoshiki Sasai from the RIKEN Centre for Developmental Biology in Kobe, Japan has created a way to grow these little organs using embryonic stem cells from mice. Using a three dimensional culture, the team arranged the mouse stem cells in a way that mimicked the way a pituitary gland grows naturally in the embryo.

When the pituitary gland grows in the embryo, it is made from two different tissue types in the brain. Where these two different tissues come together is where the pituitary gland forms. The researchers set up the culture so these two tissues would come together similar to the way they do in the brain. The fold of tissue known as Rathke's pouch formed naturally and grew into the pituitary gland. This pituitary gland took three weeks to grow and included all the cell types that are found in a normal pituitary gland.

The researchers then transplanted the tissue into mice that had pituitary problems and the hormone levels soon returned to normal.

While these pituitary glands were created with embryonic stem cells, the researchers believe they can use the same process successfully with stem cells taken from adults and avoid possible ethical concerns with the use of embryonic stem cells.

Research is planned to develop human pituitary glands though Sasai says that will take another four to five years. If successful, these lab-grown pituitary glands could be used to replace ones that have been damaged or do not function properly.

More information: Self-formation of functional adenohypophysis in three-dimensional culture, *Nature* (2011) doi:10.1038/nature10637

Abstract

The adenohypophysis (anterior pituitary) is a major centre for systemic hormones. At present, no efficient stem-cell culture for its generation is available, partly because of insufficient knowledge about how the pituitary primordium (Rathke's pouch) is induced in the embryonic head ectoderm. Here we report efficient self-formation of three-dimensional adenohypophysis tissues in an aggregate culture of mouse embryonic stem (ES) cells. ES cells were stimulated to differentiate into non-neural head ectoderm and hypothalamic neuroectoderm in adjacent layers within the aggregate, and treated with hedgehog signalling. Self-organization of Rathke's-pouch-like three-dimensional structures occurred at the interface of these two epithelia, as seen in vivo, and various endocrine cells including corticotrophs and somatotrophs were subsequently produced. The corticotrophs efficiently secreted adrenocorticotropic hormone in response to corticotrophin releasing hormone and, when grafted in vivo, these cells rescued the systemic glucocorticoid level in hypopituitary mice. Thus, functional anterior pituitary tissue self-forms in ES cell culture, recapitulating local tissue interactions.