CDB SEMINAR

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Monday, July 8, 2013
16:00~17:00 C1F Auditorium

"Organs, Not Cells" - A Vision for the Future

Summary
Recent development of iPS cell technology has enabled generation of pluripotent stem cells (PSCs) from individual patients, opening up the way to regenerative medicine using the patient's own PSC-derived cells. However, current stem cell therapy mainly targets diseases that can be treated by cell transplantation, such as Spinal cord injuries, Parkinson's disease or retinal regenerative diseases. Faced with absolute deficiency of donor organs to treat patients with organ failure, regenerative medicine has as one of its ultimate goals to generate organs using the patient's own PSCs and to transplant those organs into the patient.

We recently demonstrated in mouse the generation of functionally normal rat pancreas by injecting rat PSCs into Pdx1-/- (pancreatogenesis-disabled) mouse embryos, providing proof of principle for organogenesis from xenogenic PSCs in an embryo unable to form a specific organ (Kobayashi et al., Cell. 2010). To apply this principle to generate human organs, we need to use larger animals such as pigs. We first generated pig fetuses genetically lacking pancreata. We then investigated whether blastocyst complementation could generate pancreata in pancreatogenesis-disabled pigs as it can in pancreatogenesis-disabled rodents. Pancreatogenesis-disabled pig embryos prepared by somatic cell nuclear transfer using cells from genetically apancreatic pig fetus were complemented with blastomeres from cloned pig embryos expressing huKO fluorescent protein to produce chimeric pigs (Matsunari et al. PNAS. 2013). As in rodent models, these chimeric pigs had pancreata and survived to adulthood. The pancreata formed in chimeric pigs were about the size of human pancreas, functioned normally, and were composed of huKO-positive donor-derived cells. These adult chimeric pigs provided a pool of sperm that can produce large numbers of apancreatic pig embryos.

Demonstration of generation of a functional organ from PSCs in pigs is a very important step toward generation of human organs from individual patients' own PSCs in large animals.

Host:
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