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Functional 3D-organ regeneration as a future organ replacement therapy

In this decade, great progress has been made in the field of organ regeneration by incorporating the concept emerged from stem cell biology and developmental biology, pioneering a new frontier in regenerative medicine. Generation of bioengineered organ germ utilizing fate-determined organ-inductive epithelial and mesenchymal cells proofed the concept of functional organ regeneration in vivo. Organoid studies verified that almost all organs can be generated as mini-organ by recapitulating embryonic body patterning and establishment of organ-forming field in self-organized pluripotent stem cells utilizing cytokines mimicking patterning and positional signals during organogenesis. We previously developed an in vitro three-dimensional stem cell culture to form a three-dimensional bioengineered organ germ in the early developmental stages, termed the 'bioengineered organ germ method' (Nature Methods, 2007). We investigated the potential of the bioengineered organ germs of ectodermal organs including tooth (PNAS, 2009), hair follicle (Nature Communications, 2012) and secretory organs (Nature Communications, 2013, Nature Communications, 2013) for functional organ replacement in vivo. Recently, we generated a bioengineered three-dimensional integumentary organ system including skin appendages such as hair follicle and sebaceous gland from induced pluripotent stem (iPS) cells (Science Advances, 2016). In this symposium, I would like to talk and discuss the current trend of researches aiming functional regeneration of three-dimensional (3D) organ. I also discuss the potential usage of recent achievements and introduce a plan of a first-in-human clinical study of autologous hair follicle regeneration as a future direction to realize the next-generation organ replacement regenerative therapy.

Biography

Takashi Tsuji has completed his PhD from Niigata University and worked in JT Inc. He was Professor of Tokyo University of Science (2000-14) and is a Team Leader of RIKEN BDR (2014-Present). He is a Visiting Professor of Kobe University, Tokyo Dental University, Kwansei University, Tokyo University of Science and Keio University. He has published more than 100 papers including reviews in journals and has been serving as an Editorial Board Member of Scientific Reports. He is the Director of Organ Technologies Inc.

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