

FUNDING PROGRAM FOR NEXT GENERATION WORLD-LEADING RESEARCHERS

Project Title: Molecular basis of blastemal stem cells for morphogenic organ regeneration

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1. Background of research

Rapid progress has been made in stem cell biology and its medical application. It is, however, very difficult to restore organ morphology in mammals because mammal stem cells have no capacity for regenerating three-dimensional (3D) morphology. Unfortunately, there are few model systems of morphogenic regeneration in mammals.

2. Research objectives

This project utilizes limb regeneration and morphogenesis (using amphibians, fish, birds, reptiles, and mammals) as model systems, and we aim to understand the process of scarless wound healing in amphibians at the molecular level, to identify mechanism shared between the healing process and limb regeneration, and to establish principles of limb morphogenesis such as digit identity. We will also construct experimental systems of wound healing in mammals to apply information on regeneration of 3D structures from amphibian (and other species') limb regeneration. Our goal includes determination of conditions for successful scarless wound healing in the mouse skin.

3. Research characteristics (incl. originality and creativity)

Stem cell biology usually proceeds only in mammal systems, and it is therefore unique that we will examine conditions of stem cells for morphogenic regeneration based on information from amphibians. This project will bridge a gap between basic science of morphogenic regeneration in amphibian and other species and applied/medical stem cell biology in mammals.

4. Anticipated effects and future applications of research

In the course of the project, we will obtain information on organ regeneration and principles of limb morphogenesis that will be valuable for successful morphogenic regeneration in mammals. I am confident that the project will give rise to a significant spillover effect into not only stem cell biology but also tissue engineering, dermatology, plastic surgery and evolutionary biology.