

# FUNDING PROGRAM FOR NEXT GENERATION WORLD-LEADING RESEARCHERS

**Project Title:** Control of the Regulatory Mechanism of the Cell Division for the Expansion of Hematopoietic Stem Cells

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## 1. Background of research

Hematopoietic stem cells (HSCs) in bone marrow, which produces all types of blood cells, can be divided into two daughter cells that produce HSC(s) to maintain the HSC pool and/or committed progenitor cell(s).

Although the identification of molecular mechanism/network of the regulation of stem cell division useful for the expansion of HSCs, the mechanism of the regulation of the HSC division pattern is still unclear.

## 2. Research objectives

In this study, we analyzed the regulatory mechanisms of the cell division patterns of HSCs.

We hypothesized that the niche factors (cytokines, cell adhesion molecules, and extracellular matrixes) have influence on the choice of cell division patterns. Therefore, we would like to clarify the function of factors produced by the microenvironmental niche in the regulation of the choice of the type of cell division.

Based on this results of this research, we would like to establish the optimized culture condition that induces the expansion of HSCs.

## 3. Research characteristics (incl. originality and creativity)

To analyze the cell division of HSCs, we developed a system that enables gene expression analysis at the single cell level (single cell quantitative PCR array). Even within a seemingly homogeneous cell population, gene expression profile possibly differs dramatically in cell-to-cell level. These individual variations may be masked through averaging the studying cell samples. Therefore, analyzing expression levels of wide range of genes at the single cell level could be the key for understanding the unique characteristics of each HSC and for clarifying the complicated mechanisms determining the function of individual cells.

## 4. Anticipated effects and future applications of research

Identification of regulatory mechanism of stem cell division enables us to expand HSCs *ex vivo*. Furthermore, if we find the regulatory mechanism for leukemic stem cells (a type of cancer stem cell) division, it is applicable for the establishment of a new leukemic therapy. Moreover, a detailed understanding of the control mechanism of stem cells may contribute to the significant progress of regenerative medicine using other type of tissue stem cell and pluripotent stem cells.