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Regulation of hematopoietic stem cells division in the niche

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Hematopoietic stem cells (HSCs) divide asymmetrically or symmetrically into two daughter cells (paired daughter cells, PDCs). In the case of the asymmetric cell division, a HSC divides into one HSC and one committed progenitor cell, maintaining an adequate number of HSCs. On the other hand, in the case of the symmetric cell division, a HSC divides into a pair of identical cell, either two HSCs or two committed progenitors.

In this study, we attempted to clarify of the regulatory mechanism of the HSC division. We hypothesized that the niche signal has influence on the choice of type of cell division.

To analyze the cell division of HSCs, we developed a system that enables gene expression analysis at the single cell level. Even within a seemingly homogeneous cell population, gene expression profile possibly differs dramatically from one cell to another. Analyzing expression levels of wide range of genes at the single cell level could be key for understanding the unique characteristics of each cell and for clarifying the complicated mechanisms determining the function of individual cells.

Using the single cell Q-PCR array, we analyzed the gene expression variability among PDCs derived from highly purified long-term (LT)-HSCs. So far, we identified 27 genes as the candidates for asymmetric cell division genes. Especially, cell cycle quiescence-related genes and niche signal-related genesare unevenly expressed in PDCs. These data suggest that the regulation of the quiescence (or slow cell cycling) of HSCs by the niche factors may affect cell division pattern of LT-HSCs

Biography

Fumio Arai has completed his Ph.D at the age of 24 years from Meikai University and postdoctoral studies from Kumamoto Universityand Keio University. He is anassistant professor of School of Medicine, Keio University. His work is to clarify the mechanism of the regulation of the HSC self-renewal activity in the niche

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