

Stem Cells as Tools for Disease Research and Therapy

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Roughly classified, two different types of stem cells were identified from biological organisms. The first is ESCs isolated from preimplantation blastocyst. These early embryonic cells are proliferative for unlimited number of passages in culture and are totipotent, meaning that they can give rise to a variety of different types of cells of ectoderm, endoderm, or mesoderm. Due to their theoretical totipotency, ESCs were regarded as prime candidate for regenerative medicine, but ethical debate need to be circumvented for usig ESCs in medical applications. The other type of stem cells, adult somatic stem cells or progenitor cells, are isolated from non-embryonic tissues, such as brain, bone marrow, liver, eye, etc. These cells have a limited proliferative abilities and potencies in vitro that they can differentiate only into cells of their own lineage. Recent reports, however, provided evidences that genes of other lineages can be induced from these cells upon proper differentiation procedures suggesting a higher level of potency. Recently, existence of a third class of stem cells was proposed. These cells were isolated from mesodermal or ectodermal tissues as bone marrow, brain and muscle, and proliferated for up to 100 doublings, shared several surface antigens with MSCs, and expressed stemness-related genes that are usually found in ESCs. Multipotency of these cells was confirmed by chimeric mouse born from MAPC injected blastocyst. In addition, MAPCs isolated from muscle, brain, and bone marrow revealed similar differentiation potencies, implicating a presence of self-renewing MAPC in somatic tissues.

Up to now, we have developed 12hES cell lines and established 4 hFL-MAPC lines and distributed among about 15 research institutes to progress jointly. By using these human stem cells, we have made researches in the

differentiation of specific cell lineages specifically mesodermal cells and the in vivo functional recovery. Recently developed human stem cell lines are candidate cells which can be applied as a source of the new cell therapy and we have made researches in the derivation of differentiating into various cells and the functional recovery after transplanting living bodies. In my presentation, I would like to briefly explain the stem cell researches that have been progressing favorably in our laboratory.