Characterization of Mesenchymal Stem Cells Derived from Mouse Embryonic Stem Cells

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Embryonic stem cells (ESCs) are considered a promising cell source for regenerative medicine because of their ability to differentiate into many cell types and because of their unlimited proliferation capacity. However, there are several problems with their medical applications. For example, differentiating ESCs into a specific cell type in large quantities is very difficult. ESCs can potentially form tumors when transplanted into the patient if they are not fully differentiated. Mesenchymal stem cells (MSCs), a type of multipotent adult stem cell isolated from bone marrow, are far more advanced in their therapeutic applications. MSCs have a more specific differentiation capacity without the risk of tumor formation, but they have a low expansion capacity, limited availability, and are difficult to isolate. This project aims to generate cells from mouse ESCs with the properties of MSCs. Using retinoic acid induced differentiation, ESCs were differentiated into cells with a similar morphology to MSCs. Further analysis showed that these cells had a slower growth rate than ESCs and a different cell cycle profile as determined by flow cytometry. More importantly, they could differentiate into three distinct cell types: chondrocytes, osteocytes, and adipocytes, a major property of bone-marrow MSCs. Therefore, these cells were named embryonic stem cell derived mesenchymal stem cells (ESC-MSCs). This is very significant because these ESC-MSCs combine the advantages of each cell type. This method would allow for the large-scale production of ESC-MSCs for the treatment of degenerative diseases and injuries.

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