Differentiation Potential of Somatic versus Embryonic Stem Cells Analysed by Microarray Analysis

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Accumulating evidence suggests that differentiation of somatic stem cells tends to depend strongly on the microenvironment (plasticity) whereas embryonic stem cells create a multitude of niches more independently and behave more autonomously. In order to investigate in more detail how this may translate into differences in developmental potential we performed a comparative study of somatic stem/progenitor cells versus embryonic stem cells. We set up an in vitro system that allows autonomous self-differentiation to occur in multicellular spheroids and traced gene expression profiles using microarrays. As a source of somatic stem cells we used the apical pad-like tissue of extracted immature third molar teeth obtained from young human adults. The tissue contains neural crest-derived mesenchymal progenitor cells which were used for analysis. As embryonic stem cells the rhesus monkey cell line 366.4 (WiCell) was used. All cells were cultured in vitro under conditions that provide a homogeneous environment avoiding instructive external impact. Cells were first cultured for four days in hanging drops to trigger aggregation in a three-dimensional space. The multicellular spheroids thus formed were subsequently put in a rotating (gyratory) culture system that conserved aggregation but also allowed growth and differentiation. RNA obtained at different time points of culture was collected and analysed on whole genome microarrays (Agilent Technologies). Gene expression profiles obtained from these experiments demonstrate on one hand as expected the ectomesenchymal character of our somatic stem/progenitor cells as well as the embryonic character of the embryonic stem cells. On the other hand our data clearly depicted a distinct difference in the molecular signature developing during autonomous three-dimensional growth of embryonic stem cells versus ectomesenchymal progenitor cells. The results suggest that the gene marker sets defined in our study may be useful for characterization of the developmental potential from various types of pluripotent or multipotent stem/progenitor cells. This will help to estimate their value as a possible tool for therapy of human diseases or tissue regeneration.

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