LETTER

Another look at ''Stem cell fate dictated solely by altered nanotube dimension''

In their article, Oh et al. (1) reported that stem cell behavior on TiO_2 nanotubes can be controlled solely by altering nanotube diameter. Culturing human mesenchymal stem cells (MSCs) on a range of nanotubes with diameters between 30 and 100 nm, cell stretching and expression of osteogenic differentiation markers was highest on 100-nm nanotubes, whereas cell-adhesion rates increased with decreasing tube diameter, with a maximum at 30 nm. This finding is particularly striking in light of previous contrary reports showing that nanoscale-dependent differentiation of MSCs to osteoblasts followed in the opposite direction (2, 3). In these studies, data were presented showing that not only adhesion, proliferation, and migration, but also osteogenic differentiation of rat bone marrow MSCs were highest on 15-nm nanotubes and decreased dramatically on 70- and 100-nm nanotubes. A nanospacing of 15 nm is consistent with an optimal support of clustering of integrins, which are ≈10 nm in diameter, on the nanotube grid (2, 4, 5). Also, Arnold et al. (6) have shown that nanospacing >73 nm dramatically reduced cell spreading and the formation of focal adhesions. This discrepancy is disturbing and may have escaped the attention of Oh et al. In contrast, they presented the hypothesis that cell stretching and formation of stress fibers in MSCs observed on 70-nm but not on 30-nm TiO_2 nanotubes promoted differentiation into osteogenic cells, not taking into account the critical role of integrin clustering and focal-contact formation for cell differentiation. Further discussion and experimentation will be necessary to resolve this apparent conflict.

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