CONSORTIUM

Editorial

NANOPATTERNING: IMPLICATIONS IN REGENERATIVE MEDICINE

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Regenerative medicine is based on stem cells, which have the ability to differentiate into special type of body cells, and hence, they were proven clinically successful in organ transplantation, as well as in the functional treatment of several diseases (1). Nanotechnology, which is the science depending on particles of dimensions below 1 micrometer has gained considerable interest in the field of regenerative medicine, especially when nanoparticles are constructed from biodegradable organic and inorganic biomaterials (1).

In order to direct the spreading and adhesion of stem cells, nanopatterning has emerged as a cellular environment mimicking technique in order to control aspects related to differentiation of stem cells by virtue of their molecular interaction (2,3). It has been demonstrated that cellular differentiation can primarily be affected by changes in the geometry, dimensions and orientation of the nanopatterns (4). Several technologies were reported in the literature to create such nanopatterns, such as Dip-pen nanolithography, nanografting, polymer phase separation, metal anodization, capillary molding, preparation of nanofibrous scaffolds, and three dimensional chips (4,5).

Despite the existing and anticipated successes related to the application of nanopatterning technology in stem cell therapy, there are still many aspects that need to be addressed before clinical translation of this technology, such as the full identification of the molecular mechanisms of cell-substrate and cell-cell interactions, and the verification of whether the nanopatterned surface would allow full functioning of the stem cells or not. Moreover, the safety of these nanostructures needs to be fully explored at the molecular level before we can see further futuristic advances for these technologies, which requires an extensive research input from multidisciplinary teams in the coming period.

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