Abstract for ***Asian Deans' Forum 2018***

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Title:
Silicon-based nanopattern platform to guide and regulate the stem cell differentiation, and their application to real-time stem cell monitoring sensors

Abstract:
Stem cell-based therapies to cure nerve system disorders using the self-renewal and multilineage differentiation capacities of the transplanted stem cells have been drawing attention during the past decade. However, the critical challenges are the difficulty in: (i) guiding the stem cell's proper differentiation to adult cells, and (ii) tracking their fate, distribution, and migration due to the limited tracking methods.

In 2015, the Stevens Group at Imperial College London developed high-aspect ratio, porous silicon nanoneedles (pSi nNs) for *in vitro* and *in vivo* manipulation of cell behaviour. Remarkably, the nNs penetrate the cell membrane but do not damage the nucleus, instead stimulating nuclear condensation (Published in *Nat. Mater., ACS Nano, etc.*). However, current nNs in the Stevens Group is degradable within 48 hrs which is not ideal for long-term biological studies, especially for detecting/monitoring the cell differentiation during the culture. To overcome this problem, we newly developed non-porous, solid version of nNs. The new nNs exhibited a high stability in cell culture media and buffer solutions, proving their suitability for long-term investigation of stem cell fates and differentiation. This provides an ideal framework for manipulating and exploiting stem cell behaviour for longer periods as a means for understanding differentiation capacity of this promising stem cell source. Furthermore, we're expecting that the new nNs are modifiable as conductive electronic sensors, which further can be utilized as sensing and monitoring platforms for live stem cells.

Here, we're going to introduce our current progresses on using our new structure for exploiting stem cell behaviour for longer periods as a means for understanding differentiation capacity of this promising stem cell source. Also, we will discuss about establishing electronic-readout platform for monitoring cell fates, using our new structures.