Carbon nanotubes display intrinsic anticancer properties

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Abstract
Carbon nanotubes (CNTs) have been proposed as the technological counterpart of nature's microtubules (MTs) [1]. MTs are 25 nm diameter protein polymer nanotubes that constitute the cellular cytoskeleton and are essential for cell proliferation and migration.
CNTs and MTs share various aspects of their architecture and properties [1]. They have similar dimensions, (ii) a similar tubular morphology that ensures structural efficiency, have analogous mechanical behaviors, and are exceptionally resilient [2,3]. Their similarities are quite likely to be responsible for their association *in vitro* [4] and *in vivo* [5]. There is, however, a big difference between these polymers that has critical implications in the *in vivo* system, while CNTs are very stable polymers, microtubules are highly dynamic structures that are continuously undergoing assembly/disassembly cycles in a process known as dynamic instability [6].

Functionalized CNTs are easily translocated intracellularly [5,7]. Inside cells they assemble mixed polymers with tubulin [5]. Due to the scaffolding effect of CNTs, MTs display an enhanced stability that is critical during cell division, triggering mitotic arrest and cell death [5,8]. Interestingly, CNTs behave as microtubule stabilizing cytotoxic agents interfering with microtubule dynamics, leading to anti-proliferative, anti-migratory and pro-apoptotic effects [9]. These findings support the idea that CNTs represent a ground-breaking type of synthetic microtubule-stabilizing agents that could play a pivotal role in future cancer treatments in combination to traditional antineoplastic drugs.

References

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Figures:

Confocal microscopy image of a mitotic spindle of a dividing HeLa cell treated with MWCNT during 70 h displaying an abnormal microtubule/chromosomal organization. Microtubules are shown in the in the red channel immunostained with anti-tubulin antibody-Cy3. Chromosome miss-positioning is observed in the blue channel, Hoechst staining. Scale bar 2µm.