Cancer treatment by Nano-Diamonds
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Abstract
Cancer cells have unique properties that can be exploited by nano-particles. Their rapid rate of growth causes them to intake an abnormal amount of nutrients (i.e., folic acid). Nano-particles (NP) can be used to target bio-markers or antigens that are highly specific to cancer cells. The nano-particles are typically between 20-150 nm or roughly 100 times smaller than most human cells. In the nanotechnology methods, certain NP can be designed to absorb preferentially certain wave length of radiation and if they enter in the cancerous cells, they will burn them. Nanotechnology can be used to create therapeutic agents that target specific cells and deliver toxin to kill them. The NP will circulate through the body, detect cancer associated molecular changes, assist with imaging, release a therapeutic agent and then monitor the effectiveness of the intervention.

Diamond nano-particles are now finding new and far-reaching applications in modern biomedical science and biotechnologies. Due to its excellent biocompatibility, nano-diamonds serve as versatile platforms that can be embedded within polymer-based microfilm devices. The nano-diamonds are complexed with a chemotherapeutic, and subsequently enable sustained/slow release of the drug for a minimum of one month, with a significant amount of drug in reserve. This opens up the potential for highly localized drug release as a complementary and potent form of treatment with systemic injection towards the reduction of continuous dosing, and as such, attenuation of the often powerful side effects of chemotherapy.

Nano-diamonds are quite economical, enabling the broad impact of these devices towards a spectrum of physiological disorders e.g. serving as a local chemotherapeutic patch, or as a pericardial device to suppress inflammation after open heart surgery. A substantial amount of drug can be loaded onto clusters of nano-diamonds, which have a high surface area. The nano-diamonds are then put between extremely thin films of parylene, resulting in a device that is minimally invasive.

Nano-diamond patch could be used to treat a localized region where residual cancer cells might remain after a tumor is removed. If a tumor has to be removed from the breast or brain, the device could be implanted in the affected area as part of the same surgery. This approach, which confines drug release to a specific location, could mitigate side effects and complications from other chemotherapy treatments.

Thus, the nano-diamonds can be used to explore a broad range of therapeutic classes, including additional small molecules, proteins, therapeutic antibodies, RNAi, etc.