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Cancer-cell-specific mitochondria-targeted drug delivery by dual-ligand-functionalized nanodiamonds circumvent drug resistance

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The application of nanodiamond is rapidly expanded from diagnosis to treatment due to its promising drug loading and non-photo-quenching imaging properties. However, the delivery of sufficient drug amount to the targeted disease site is greatly important in therapeutics. Hence, we developed a cancer-cell-specific sub-cellular organelle-targeted delivery based on photostable Nanodiamond (ND), which is functionalized with folic acid and Mitochondrial Localizing Sequence (MLS) peptides. This dual-ligand-functionalized ND platform does not only distinguish the cancer cells via the overexpression of folate receptors on cell membrane, it also localizes to mitochondria. Importantly, the Doxorubicin (DOX) loaded dual-ligand-functionalized ND platform induces a significant cytotoxicity in drug resistance cancer cell (MCF-7/ADR) comparing to the free Doxorubicin localized in lysosomes because the localization in mitochondria enhances the retention time of DOX inside the MCF-7/ADR, which has the significant circumvention of P-glycoprotein to pump out the drug inside the cell. This work successfully demonstrates nanodiamond-based nanocarriers for cancer-cell- specific mitochondria-targeted delivery and overcomes drug resistance in Doxorubicin-resistant human breast adenocarcinoma cancer cells.

Biography

Miu Shan Chan is a Postgraduate student in Dr. Peggy Lo's research group in City University of Hong Kong. She focuses on the development of the nanomaterials, such as, biomolecular sensors, fluorescent imaging probes, creation of DNA-based nanostructure and bio-functionalization of nanoparticle. She studies the biological applications of different synthetic molecules such as organelles tracking, biomolecules targeting, ROS detection and cellular protection from ROS. She has developed different nanoplatforms as drug nanocarrier with specific organelle targeting.

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