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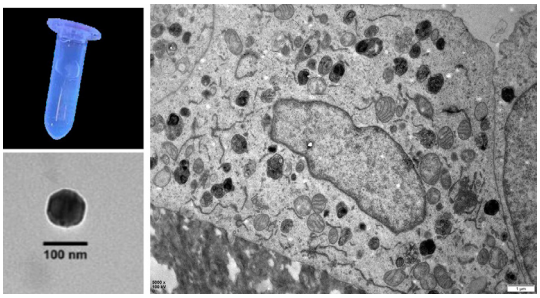
Nanotheranostic system is proven to target and kill osteosarcoma cells



A rare cancer that usually occurs in the long bones of the arms and legs, osteosarcoma affects some 3.4 million people, mostly children and young adults, every year. Unfortunately, existing treatments have some serious shortcomings. Most significantly, chemotherapeutic drugs used to treat the bone cancer don't always reach the tumorous cells and can circulate freely in the body, causing significant side effects and hindering recovery.

For the last few decades, scientists have been trying to develop "nanotheranostic" systems that combine drug delivery with imaging capabilities to enable real-time tracking of the compounds within the body.

Desmond et al. developed a novel nanotheranostic platform using an environmentally friendly technique called "layer-by-layer assembly" to create a nanoscale coating. This platform is capable of incorporating two chemotherapeutic drugs simultaneously and includes carbon quantum dots (QCDs) to serve as imaging probes.

"Interestingly, these QCDs are derived from chitin, a natural source found abundantly in the exoskeletons of crustaceans, insects, and the cell walls of fungi," said author Piergiorgio Gentile.

To prepare the QCDs, the researchers used what is called the "pyrolysis-carbonization method." The two-step process converted the chitin biomass first, via pyrolysis, into carbon-rich materials; and then converted those, via hydrothermal carbonization, into CQDs.

The final size of the systems they fabricated was approximately 150 nm; and, ultimately, they were shown to deliver the controlled release of both chemotherapeutic drugs.

"When tested on two types of cells from osteosarcoma tumors, our nanotheranostic systems effectively killed the cancer cells," said Gentile. "We think this represents enormous potential for the development of new drugs to better treat osteosarcoma."

Source: "Layer-by-layer assembly of nanotheranostic particles for simultaneous delivery of docetaxel and doxorubicin to target osteosarcoma," by Liam Desmond, Simone Margini, Emilio Barchiesi, Giuseppe Pontrelli, Anh N. Phan, and Piergiorgio Gentile, *APL Bioengineering* (2024). The article can be accessed at https://doi.org/10.1063/5.0180831.