Cancer drugs hitch a ride on 'smart' gold nanoshells

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Nanoparticles capable of delivering drugs to specifically targeted cancer cells have been created by a group of researchers from China.

The multifunctional 'smart' gold nanoshells could lead to more effective cancer treatments by overcoming a major limitation of modern chemotherapy techniques—the ability to target cancer cells specifically and leave healthy cells untouched.

Small peptides situated on the surface of the nanoshells are the key to the improved targeting ability, guiding the nanoshells to specific cancer cells and attaching to markers on the surface of the cells. The acidic environment of the cancer cells then triggers the offloading of the anticancer drugs.

The specific nanostructure of the gold nanoshells could also allow near-infrared light to be absorbed and converted into heat, opening up the possibility of using the nanoshells in targeted hyperthermia treatment—another form of cancer treatment whereby cancer cells are exposed to slightly higher temperatures than usual to destroy them.

The first results of the nanoshells' performance have been published today, 14 February, in IOP Publishing's journal *Biomedical Materials*.

The researchers, from East China Normal University and Tongji University, used the gold nanoshells as a building block to which they attached the commonly used anticancer drug Doxorubicin (DOX) and a

specific peptide known as A54.

The gold nanoshells had diameters of around 200 nanometres—more than 50 times smaller than a red blood cell.

When tested on human liver cancer cells, the uptake of the nanoshells that had the A45 peptide was three times greater than the uptake of the control nanoshells without the peptide. There was also a significantly reduced uptake of both types of nanoshell by normal healthy cells.

The cancer cells were also treated with the gold nanoshells in a heated water bath and were shown to deliver a notable therapeutic effect compared to just the chemotherapy, demonstrating the potential of the hyperthermia treatment.

Lead author of the study Dr Shunying Liu, from East China Normal University, said: "The therapeutic activity of most anticancer drugs is limited by their systematic toxicity to proliferating cells, including some normal cells. Overcoming this problem remains a great challenge for chemotherapy."

"In our study we placed a targeting peptide on the nanoshells, which have been demonstrated to be specific to live cancer cells, improving the targeting ability and drug delivery of the gold nanoshells.

"The next step of our research is to test the 'smart' gold nanoshells in vivo on a liver cancer mouse model. We will also examine how the size of the nanoshells changes their efficacy and how efficient the nanoshells are at converting near-infrared light into heat."

More information: "'Smart' gold nanoshells for combined cancer therapy and hyperthermia" 2014 *Biomed. Mater.* 9 025012. iopscience.iop.org/1748-605X/9/2/025012

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