Counting cancer-busting oxygen molecules

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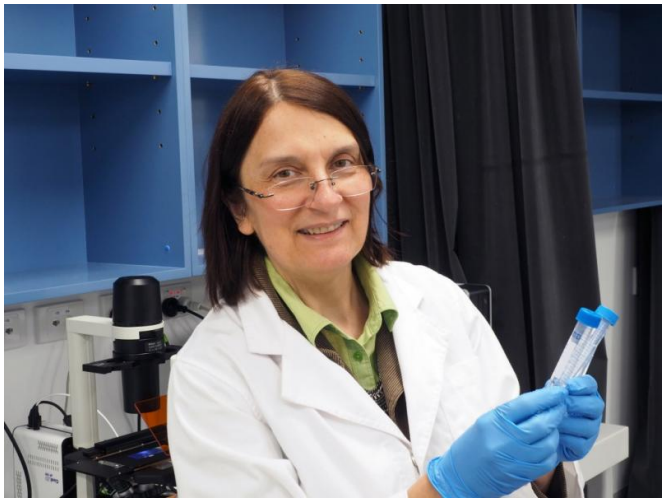

Professor Ewa Goldys

Researchers from the Centre for Nanoscale BioPhotonics (CNBP), an Australian Research Centre of Excellence, have shown that nanoparticles used in combination with X-rays, are a viable method for killing cancer cells deep within the living body.

The research, published in the journal *Scientific Reports* is based on the successful quantification of singlet oxygen produced during photodynamic therapy for cancer. Singlet oxygen molecules (a highly reactive form of oxygen) are able to kill or inhibit growth of cancer cells in the body due to their toxicity.

Co-lead author on the paper, Ewa Goldys, Deputy Director of the CNBP and Professor at Macquarie University explained, "Photodynamic therapy is where light sensitive compounds are placed near diseased cells, then activated by light, producing short lived molecular by-products that can destroy or damage the cells being targeted."

"In this case, X-rays (a form of light) were used to stimulate cerium fluoride (CeF3) nanoparticles which had been placed near a group of cells. Singlet oxygen was produced as a by-product of the X-ray and CeF3 interaction, which was then successfully measured."

Goldys believes the research is significant, as this is the first time that anyone has been able to quantify accurately, the number of singlet oxygen molecules produced in this type of procedure.

"Singlet oxygen molecules are a far more reactive form of oxygen but they can only kill cancer cells if generated in sufficient quantity", said Goldys.

"In our testing we established that therapeutic radiation dose X-rays, produce enough singlet oxygen molecules to be effective in photodynamic therapy."

According to Goldys, photodynamic therapy has traditionally utilised near-infrared or visible light which has been unable to penetrate far into the body, limiting its use to cancer treatment, on or near the surface of the skin.

"We're looking to target cancer cells deeper in the body hence the use of X-rays, which can really penetrate into deeper levels of tissue, and are already used in medical diagnostic and therapy.'

Concluded Goldys, "What we've shown through our measurements is the applicability of the photodynamic therapy approach to effectively treat tumours within."

"The beauty of this type of treatment is that it uses different biological pathways to kill cells as compared to chemotherapy, radiotherapy and other current cancer practices.

"Deep tissue photodynamic therapy will potentially provide new treatment options for the cancer patients of the future."

Next steps with this research will see differing nanoparticles tested and measured, for

effectiveness in singlet oxygen production.

More information: Sandhya Clement et al. X-ray induced singlet oxygen generation by nanoparticle-photosensitizer conjugates for photodynamic therapy: determination of singlet oxygen quantum yield, *Scientific Reports* (2016). DOI: 10.1038/srep19954

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