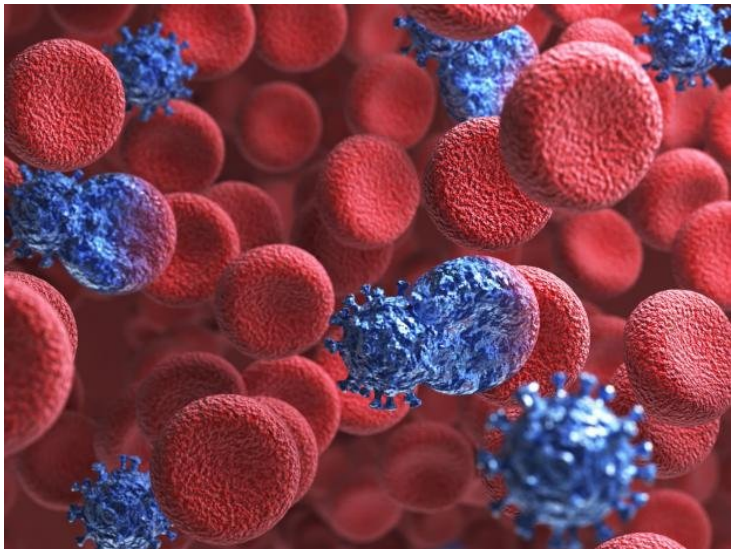
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Amrita scientists discover new way to kill cancer cells

30 January 2018 | News

This discovery is a big leap forward in the safe treatment of cancer using heat generated by radio waves.



In major medical breakthrough, scientists of Centre for Nanosciences and Molecular Medicine at Kochi's Amrita Institute of Medical Sciences have succeeded in turning nanoparticles of calcium phosphate – a biomineral naturally found in human bones – into fully biodegradable radio frequency (RF) agents and made them imageable by MRI and CT scans. This has paved the way for safer, cheaper diagnosis and treatment of cancer. The project has been funded by the Dept. of Biotechnology, Govt. of India.

Dr. Shanti Nair, Director, Centre for Nanosciences and Molecular Medicine, Amrita Institute of Medical Sciences, Kochi said, "The development of calcium phosphate nanoparticles with imageable properties for drug delivery applications is a major innovation in the quest to develop biodegradable contrast agents for imaging (diagnostic) purposes. Calcium phosphate is naturally found in human bones and is non-toxic and fully biodegradable. Now that its nanoparticles have been made imageable by MRI and CT scans, their accumulation in tumours can be verified and the MR contrast used for image-guided surgical treatment of cancer."

Currently, the most common treatment for cancer involves radiation and use of gamma rays to kill cancer cells. However, this inflicts collateral damage – healthy cells also get destroyed along with cancer cells. Radiation treatment with Cyber-Knife is much more precise, but very expensive. In this situation, the most easily accessible and cheapest cancer treatment available today uses radio frequency (RF) microwaves. But for this method to work, the RF agent should be non-toxic to human body and preferentially accumulated in the tumour. This is where the development of calcium phosphate nanoparticles as a biodegradable RF agent becomes significant.

The project's key principal investigator Dr. Manzoor Koyakutty, Professor, Centre for Nanosciences and Molecular Medicine, Amrita Institute of Medical Sciences, Kochi, explained, "The main advantage of calcium phosphate is that our body does not treat it as foreign material, leading to minimum toxicity and immune rejection compared to other engineered nanoparticles which are non-biodegradable. We have made this biomineral imageable using MRI and CT. It can be guided precisely to cancer tumours, which will enable their treatment under image guidance, using radio waves to heat up and destroy the cancerous cells. We are now conducting large animal studies, after which clinical trials will follow."

The team of co-inventors has launched a new company which has already acquired the rights from Amrita Institute of Medical Sciences to bring the product to clinics. This spin-off venture is supported by the Biotechnology Innovation Grant of Department of Biotechnology, Govt. of India.

The discovery of RF hyper-thermic property (heat generation under radio waves) of calcium phosphate was by chance. A team of researchers at Amrita Centre for Nanosciences and Molecular Medicine, including Dr. Anusha Ashokan, Dr Vijay Harish and Dr GS Gowd, was doing experiments to optimize MRI imaging and RF properties of some calcium-containing materials. During experimentation, they accidentally found that the calcium compound was getting heated up when exposed to radio waves. This led to the optimization of calcium phosphate nanoparticles for RF applications. The scientists enhanced their hyper-thermic properties by doping them with iron nanoparticles having magnetic properties, which also helped in magnetic resonance imaging.

Dr. Vijay Harish, Physician Scientist, Dept. of Nuclear Medicine, Amrita Institute of Medical Sciences, Kochistated, "Image guided therapy using biodegradable material such as calcium phosphate is very attractive from the clinical perspective. It will allow doctors to treat cancer patients with precision."