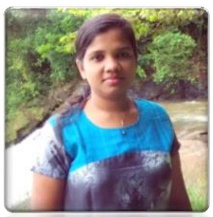
Indian Institute of Science

Centre for BioSystems Science and Engineering

BSSE Annual Work Presentation

March 18th 2019, 4:00 PM, MRDG Seminar Hall, 1st floor, Biological Sciences Building

Multifunctional magnetic nanomotors as radiosensitizers



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ABSTRACT

Nanomotors are micro-nano sized particles that can be actuated by chemical, magnetic, acoustic or biological methods which have potential applications in targeted drug delivery, precision surgery, medical diagnostics and detoxification. Our helical magnetic nanomotors can be propelled by an externally applied rotating magnetic field which is a scalable, noninvasive form of actuation with minimal effects on organisms. Spatiotemporal manipulation and multifunctionality of these motors have been demonstrated for movement in blood, magnetic hyperthermia, active colloidal manipulation, maneuverability inside living cells, and measurement of local viscosity. These properties of helical magnetic nanomotors may be exploited for theranostics in live organisms. Conventional radiotherapy uses high intensity ionizing radiations, i.e., x-rays and gamma rays. Targeting of tumor cells is achieved to some extent by using multiple shaped radiation beams in such a way that the tumor is located at the point of intersection of these beams (where the intensity is maximum). Radiosensitizer is an agent that makes tumor cells more sensitive to radiation therapy. Gold nanoparticles have been proven to be radiosensitizers. Preliminary studies have also reported radiosensitization properties for silver, silica and iron oxides. Since the nanomotors, which are composed of silica, iron, and silver, are controllable in a biological environment, attaching gold to the motors may provide a system capable of localized radiosensitization. Here, we look at the radiosensitization effects of nanomotors on human breast cancer cells. In-vitro studies on MDA-MB-231 cells show radiosensitization effects of nanomotors. We have developed a bioluminescent human xenograft breast tumor model in nude mice and are developing a bioluminescent mouse breast tumor model in BALB/c mice which will be used for in-vivo experiments on radiosensitization. Further, we will study the in-vivo biocompatibility and biodistribution of the nanomotors.