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Nanodrug design and methods of activation for cancer therapy

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Abstract

Nanomedicine is the use of nanoparticles in medical practice for improving imaging, drug delivery and therapy. Nanophotothermolysis and nanophotohyperthermia are two new techniques which exploit the strong light absorption properties of nanoparticles to generate heat in the body. Nanophotohyperthermia elevates the temperature slightly for some time seeking to disrupt the viability of certain cells or cell functions. Nanophotothermolysis seeks to create extremely high temperatures on very short timescales in order to actively destroy cell membranes and physically damage the cells beyond repair. Nanoparticles can be combined with cancer-targeting molecules, allowing the nanoparticles to be accumulated on the unhealthy cells only. When the radiation is turned on, these nanoparticles, which are strong radiation absorbers, heat up much more quickly than any of the surrounding tissues. Unfortunately, biological tissues are very good at scattering visible light, which leads to lower light intensities reaching the nanoparticles. Researchers are currently trying to find wavelengths that make a good compromise between maximizing heat generation in the nanoparticle and minimizing the scattering and absorption by surrounding tissues. For that reason, this paper investigates the design of nanodrugs (morphological and physical properties) and methods of their activation over a wide range of the radiation spectrum (X-rays, optical and radiofrequencies).

Biography

Professor Renat R. Letfullin has studied nanomedicine, nanotechnologies, laser physics and optics for 25+ years, during which time he has authored more than 150 papers and conference proceedings, including 12 book chapters in 10 different books. He is an editor of the *International Journal of Theoretical Physics, Group Theory and Nonlinear Optics*, and he serves on the editorial boards of the *Science and Healthcare Journal* and the *International Journal of Methodology*. Dr. Letfullin is director of the Nanotechnology and Nanomedicine Program at Radiological Technologies University, South Bend, IN. He is a member of the SPIE, OSA and ASEE professional societies.