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Editorial

Editorial: The May 2023 cover paper

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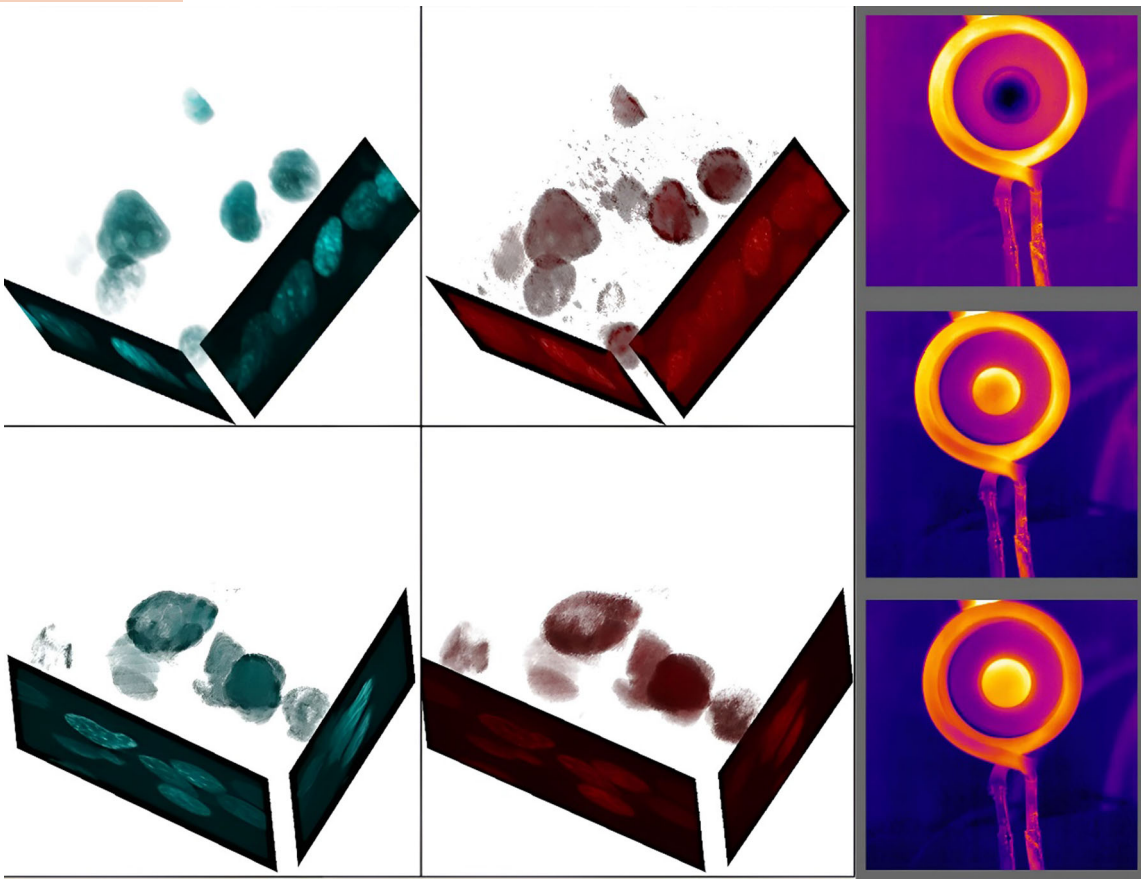
GRAPHICAL ABSTRACT



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The cover for the May 2023 issues of the Journal of Materials Science comes from the paper by Dagdelen et al., which appeared in volume 58, issue 9, published in March 2022 [1]. The paper is entitled "Redox-responsive degradable microgel modified with superparamagnetic nanoparticles exhibiting controlled, hyperthermia-enhanced drug release" and is part of our "Materials for life sciences" topical collection. Some of the more visually striking data is represented in the cover image and it is explained in detail in the paper itself.

The paper describes the synthesis and in-vitro testing of a hydrogel composite that is designed to maximize toxicity to cancer cells by both efficiently delivering the cancer drug doxorubicin (DOX) and overheating the cells with magnetically induced hyperthermia. DOX is an effective cancer drug but is not without its drawbacks. The first concern with the use of DOX is its poor water solubility and tendency to precipitate in buffer solutions. This makes it highly desirable to develop a delivery system that can encapsulate the drug, bring the drug directly to the cancer cells then release the drug into the cancer tumor or cells. The hydrogel in this paper is designed to do just that, by using controlled release from a hydrogel to deliver the drug quickly and at a relatively high concentration to the interior of cancer cells. Second, DOX is also quite toxic to non-cancerous cells, leading to serious side effects in patients, meaning selective delivery to cancerous cells is important for this drug. Many nanotechnology-based cancer treatments take advantage of the enhanced permeability and retention (EPR) effect seen in cancer cells [2]. The EPR effect can help concentrate the nanocomposite in cancerous cells, but quick release of the drug from the hydrogel is also desirable. This is achieved in this study by including a linker in the hydrogel that can be reduced by the glutathione concentrations present in the endocellular environment. The paper demonstrates the release in environments mimicking the endocellular environment and by using in-vitro experiments (including the ones represented on the cover).

Multi-modal treatments have become routine in cancer treatments to maximize the therapeutic killing of cancer cells, while minimizing the impact of side effects. The material described in this paper brings a second therapeutic in the form of magnetic nanoparticles that can be heated by an alternating magnetic field to locally heat and kill cancer cells in a treatment called hyperthermia [3]. In this material, though, there is also a thermally responsive polymer, poly(N-isopropylacrylamide), that has been shown to induce drug release when heated above its transition temperature [4]. In the current study, the authors show a dramatic release of DOX upon heating the hydrogel, by magnetic hyperthermia, to a temperature of 42 °C.

These kinds of single material, multimodal treatments can be expected to have a dramatic effect in the clinic when they are eventually deployed. This trend toward more complex and intricately entwined biomedical materials is not only a practical response to clinical concerns but makes for enjoyable reading in the scientific literature.

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