Title:	Biodegradable Protein-Stabilized Inorganic Nanoassemblies for Photothermal Radiotherapy of Hepatoma Cells
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Abstract:	Inorganic nanomaterials require optimal engineering to retain their functionality yet can also biodegrade within physiological conditions to avoid chronic accumulation in their native form. In this work, we have developed gelatin-stabilized iron oxide nanoclusters having a primary crystallite size of ∼10 nm and surface-functionalized with indocyanine green (ICG)-bound albumin-stabilized gold nanoclusters (Prot-IONs). The Prot-IONs are designed to undergo disintegration in an acidic microenvironment of tumor in the presence of proteolytic enzymes within 72 h. These nanoassemblies demonstrate bio- and hemocompatibility and show significant photothermal efficiency due to strong near infrared absorption contributed by ICG. The surface gold nanoclusters could efficiently sensitize hepatoma cells to γ-irradiation with substantial cytoskeletal and nuclear damage. Sequential irradiation of Prot-ION-treated cancer cells with near infrared (NIR) laser (λ = 750 nm) and γ-irradiation could cause ∼90% cell death compared to single treatment groups at a lower dose of nanoparticles. The superparamagnetic nature of Prot-IONs imparted significant relaxivity (∼225 mM–1 s–1) for T2-weighted magnetic resonance imaging. Additionally, they could also be engaged as photoacoustic and NIR imaging contrast agents. This work demonstrates bioeliminable inorganic nanoassemblies with significant theranostic potential.
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