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Functionalized nanoparticles for drug delivery, one and two photon photodynamic therapy as a promising treatment of retinoblastoma

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Abstract

Retinoblastoma is a rare and unique cancer that forms in the eyes of children, often before they are born. It is a complicated disease triggered by genetic mutations in one or more cells of the retina. In industrialized countries, 95 % of patients are cured by chemotherapy and conservative treatments. However these treatments can increase the risk of secondary tumors in patients with a constitutional alteration of the RB1 gene. Photodynamic therapy (PDT) represents a therapeutic approach and may reduce the incidence of secondary tumors. PDT is an established cancer treatment based on the light activation of a photosensitizing agent thus generating cytotoxic reactive oxygen species that cause cellular damage.

We focused on mesoporous silica nanoparticles (MSN) for one photon excited PDT combined with drug delivery and carbohydrate targeting applied on retinoblatoma. We demonstrated that bitherapy (campothecin delivery and PDT) performed with MSN was efficient in inducing retinoblastoma cell death. Alternatively MSN designed for two-photon excited PDT were also studied and irradiation at low fluence efficiently killed retinoblastoma cancer cells.

These data provide new evidences of the potential of functionalized and targeted MSN for treatment of retinoblastoma and could lead to propose a non-invasive therapy with reduced side-effects. Currently, we are investigating for the mannose receptors overexpressed in retinoblastoma in order to synthesize high affinity mannose-functionalized MSN.

Biography

Audrey Gallud is a PhD student member of the new team “Glyco and nanovectors for therapeutic targeting at “Institut des Biomolécules Max Mousseron” (IBMM) in Montpellier, France. She has a Master degree in chemistry and biology and she is currently working on the photodynamic therapy of retinoblastoma and other cancers, through one and two photon excitations, with Dr Magali Gary-Bobo and Dr Marcel Garcia (one published paper and three on submission). Moreover, she is specialist of lectin-targeting nanoparticles in cancer.