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A new generation of nanovectors tackling brain cancer

G. Ciofani[1]

[1] Istituto Italiano di Tecnologia, Smart Bio-Interfaces, Viale Rinaldo Piaggio 34, 56025 Pontedera (Pisa), Italy; gianni.ciofani@iit.it

The current advances in nanotechnology allows for a wide spectrum of possible applications in different fields, in particular in medicine. In fact, nanoparticles can be exploited as efficient drug delivery systems thanks to their capacity to encapsulate high payloads of drugs that are otherwise poorly soluble in the biological milieu, increasing their bioavailability and biocompatibility. In other cases, nanoparticles can act themselves as a therapeutic or diagnostic agent (*e.g.*, superparamagnetic iron oxide nanoparticles, -SPIONs-).

In this context, the aim of the Smart Bio-Interfaces research line is to develop and investigate new multifunctional nanoparticles, specifically engineered to respond to external stimuli and/or to selectively target diseased cells, in particular cancer cells. For instance, nanostructured lipid carriers (NLCs) offer several advantages as compared to other systems, such as a relatively easy, green, low-cost and scalable preparation protocol, biocompatibility and biodegradability ensured by the lipid constituents, a high drug payload and physicochemical stability in bodily fluids. We demonstrated that NLCs loaded with SPIONs and a chemotherapeutic agent were able to selectively induce apoptosis in glioblastoma multiforme cells.[1,2] In the aim of reaching full targeting potential and provide a patient-personalized treatment, we are now working on developing new nanocarriers based on NLCs and coated with extract of glioblastoma cell membranes derived from patients biopsies. Cancer cell membrane coating confers extraordinary targeting abilities to the nanovectors, increasing the accumulation of therapeutics in diseased tissues and significantly reducing side effects.[3] These nanovectors will co-deliver both SPIONs, for hyperthermia treatment and chemotherapeutic drugs. The targeting efficiency, the ability of crossing the blood-brain barrier, and the selective anticancer activity of the nanovectors will be studied by means of state-of-the-art fluidic systems developed in our group to closely mimic the complex tumor microenvironment *in vitro.* This work will be of great importance in the development of new technologies for precision medicine and for theranostic applications, thanks to abilities of SPIONs to act both as a therapeutic tool and MRI contrast agent, depending on the magnetic field used. Moreover, thanks to the versatility of the formulation and testing tools, this new approach could be easily remodeled to be applied to the study and treatment of other diseases.

References

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