Decorated nanogels as promising tools for selective drug delivery in spinal cord injury

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Introduction
Spinal cord injury (SCI) is characterized by the primary SCI, that is the consequence of the traumatic event, and by the subsequent inflammatory response, characterized by the activation of microglia/macrophages/astrocytes, that leads to an aggravation of the pathology and to neurodegeneration [1,2]. A possible therapeutic approach is represented by the possibility to modulate the inflammatory response through the release of drugs in the damaged zone selectively within different cell lines. Recent advances in polymer science and nanotechnologies showed an increased interest for the nanogels (NGs), a new class of colloidal systems that can be used as carriers to treat SCI.

Material and Methods
Nanogels were synthesized using polyethylene glycol(PEG) and polyethylenimine linear(PEI), after having functionalized PEI with a chromophore [3, 4]. This PEI functionalization is essential for being able to constantly trace the nanogels during the biological assays. Many different coating strategies of the nanogels were analyzed: in fact, the surface functionalization is essential to tune the characteristics, and the biological behavior, of the final system.

Results and discussion
Biological tests proved that functionalized nanogels were able to be selectively internalized in mouse microglia or astrocytes depending on their surface decoration, that their degradation promoted drug release and the use of anti-inflammatory molecules as delivered drug were able to mitigate the pain state [5, 6]. *In vivo* subsequent assays on diseased mouse confirmed the result obtained *in vitro* and the potentiality of this kind of surface functionalization.

Conclusions
Nanogels are for sure effective devices in drug delivery and here we showed their potentialities as targeted drug delivery systems in SCI.

References
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