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Dependence of *in vivo* tumor homing, localization and therapeutic effect of colloidal nanoparticles on the number of attached antibodies

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Colloidal nanoparticles (NPs) are a versatile tool to integrate nanotechnology and biology, provided that they are complemented with a proper surface functionalization. To this aim, several strategies have been proposed in the attempt to optimize the surface modification of NPs with organic and biological targeting ligands to improve the NP affinity towards biological receptors (1). Several studies have been developed to achieve a control on linkage stability (2), as well as on ligand orientation and density (3). However, a general strategy to introduce a discrete precisely controlled number of targeting biomolecules to each NP is still largely missing. In particular, active targeting of NPs to tumors can be achieved by conjugation with specific antibodies. In the present work (4), specific active targeting of HER2 receptor is demonstrated *in vitro* and *in vivo* with a subcutaneous MCF-7 breast cancer mouse model with trastuzumab-functionalized gold nanoparticles (Au NPs), utilizing IgG antibody-modified Au NPs as nonspecific control. The number of attached antibodies per NP was precisely controlled in a way that each nanoparticle was conjugated with either exactly one (5NP-1Tz), or exactly two antibodies (5NP-2Tz). *In vitro* we found a moderate increase in targeting efficiency of nanoparticles with two instead of just one antibody attached per nanoparticle. However, despite an intuitive belief that also *in vivo* targeting efficiency should rise upon increasing the amount of antibodies per nanoparticle, the *in vivo* data demonstrate that best effect is obtained for nanoparticles with only exactly one antibody per nanoparticle. There is indication that this is based on as size-related effect. These results highlight the importance of precisely controlling the ligand density on the nanoparticle surface for optimizing active targeting, and that less antibodies can exhibit more effect.

Biography

Dr. Prosperi is an Associate Professor in Biochemistry at the University of Milano-Bicocca. Since 2008, he is the head of the NanoBioLab, http://www.nanobiolab.btbs.unimib.it. His research activity has been focused on biomedical and biophysical applications of Nanotechnology. His current scientific interests concern: synthesis, functionalization and characterization of nanoparticles for biomedical applications; biophysical studies on colloidal systems; studies of interaction of nanostructures with biological systems. The group of DP has developed innovative methods for surface bioengineering of colloidal and biomimetic nanoparticles and for the characterization of resulting hybrid nanoparticles. He is an author of over 90 scientific publications.

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