GLYCONANOPARTICLES: MULTIFUNCTIONAL NANOMATERIALS FOR BIOMEDICAL APPLICATIONS

Soledad Penadés
Laboratory of GlycoNanotechnology, Biofunctional Nanomaterials Unit, CICbiomaGUNE and CIBER-BBN, Parque Tecnológico, Pº de Miramon 182, 20009 San Sebastian, Spain
spenades@cicbiomagune.es

During the last years our laboratory has developed a new technology (*Glyconanotechnology*) for tailoring - in a simple and versatile way – bio-functional gold nanoclusters (glyconanoparticles, GPNs). [1,2,3] The GNPs present some advantages over other previously prepared colloids as: 1) easy preparation and purification; 2) exceptional small core size and narrow distribution sizes; 3) control over ligands number and nanoparticles size; 4) water solubility; 5) high storage stability without flocculation; and 6) singular physical properties.[4] The manipulation of the metallic cluster to obtain luminescent *glyco*-quantum dots (semiconductors) [5] and magnetic nanoparticles for application in cellular labelling and imaging by magnetic resonance (MRI), is comprised within the potential of this novel technology. Furthermore, the introduction of additional ligands can be used to guide the assembly of the nanoclusters creating a wealth of different nanostructures. [6]

GNPs with biological significant carbohydrates (antigens) and with differing carbohydrate density have also been prepared to study biological mechanisms [1, 7, 8] and to intervene in cell adhesion processes.[9] The methodology includes the preparation of *hybrid* GNPs incorporating carbohydrates and other molecules such as fluorescent probes, biotin as well as biological molecules such as peptides, DNA and RNA etc.
The biofunctional nanoclusters presented here has the potential to integrate all the current knowledge and applications on processes that involve both Nanomaterial Science and Biology and to complement the current gene oriented Nanobiotechnology. [10]

The design and preparation of complex bio-functional glyconanoparticles (GNPs) and their application as polyvalent tools to study and intervene in carbohydrate mediated biological interactions will be highlighted. As examples of application in Nanomedicine, the preparation and study of GNPs as anti-adhesion agents in inhibition of metastasis, as potential microbicides for blocking HIV-1 infection, or as anti-cancer vaccines will be discussed. In addition, magnetic glyconanoparticles for application in cellular labeling and magnetic resonance imaging (MRI) will also be reviewed.

References:

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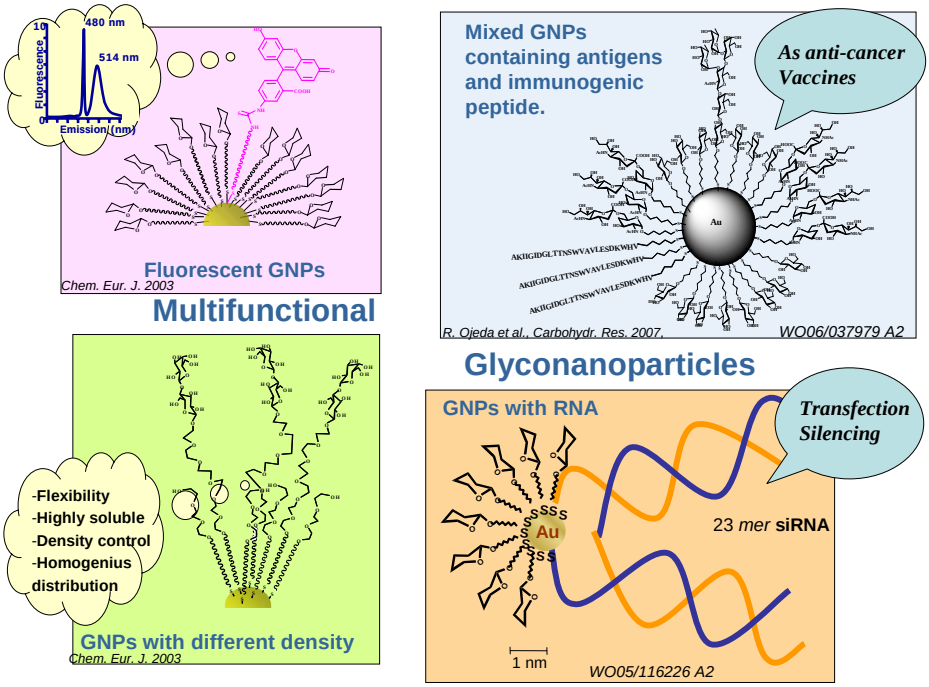

Figure 1: Some of the multifunctional glyconanoparticles prepared for biomedical applications