NANOPARTICLES FOR THERAPEUTICS AND DIAGNOSTICS

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During the last years, there has been a great deal of interest in the self-assembly fabrication of hybrid materials from inorganic nanoparticles and biomolecules[1] Gold glyconanoparticles are constituted by a gold core and a self-assembled monolayer of carbohydrates. They are the most stable metal nanoparticles and present interesting properties which include a wide array of assembling model and size-related electronic, magnetic and optical properties. The glyconanoparticles constitute a good bio-mimetic model of carbohydrate presentation at the cell surface [2], so they can be considered as nanocells.

At Midatech we design and manufacture nanoparticles for therapeutics, diagnostics and coatings for devices including microchips.

Our biocompatible nanocells are manufactured through a one-step current Good Manufacturing Practise (cGMP) process in which the nanocells self-assemble. Manufacture is therefore simple, safe, scaleable and low cost.

Our nanocells have properties that make them ideal as drug delivery vehicles:

- They are water soluble and can be designed to either diffuse freely in vivo, or to target specific cells.
- A class of our nanocells have been shown to cross the Blood Brain Barrier.
- With a diameter of less than 5nm, unbound nanoparticles are freely excreted from the kidneys, reducing the likelihood of non-specific in vivo accumulation.
- Multiple ligands can be attached to a single nanoparticle, so multivalent drug delivery or receptor binding is possible, as well as heterogeneous ligand delivery.

Owing to these properties, nanocell vaccines have been made incorporating all components required to simultaneously stimulate the multiple arms of the immune system as well as the antigenic structures.

Nanocells are superparamagnetic, enabling them to be used as both non-invasive imaging agents (MRI), and as vehicles for inducing cell suicide by hysteresis heating (apoptosis caused by heating of an intracellular or cell-surface bound nanoparticle with an alternating magnetic field), a procedure being exploited as thermotherapy for both bacterial infections and cancers.

Figure 1.- *Representative picture of nanocells.*

Our vision is to harness the vast potential of our nanocells to improve therapies for human diseases, (including cancer and infectious disease).

We seek to apply and partner this exciting technology in areas of unmet medical need, and to improve current drugs and vaccines.

References:

[1] C.M. Niemeyer, *Angew. Chem., Int. Ed.* **40** (2001), pp. 4128–4158.

[2] J. M. de la Fuente, S. Penadés, *BBA* **1760** *(2006),* 636-651