

## Design and *in vivo* Validations of Nanosystems in Cardiovascular

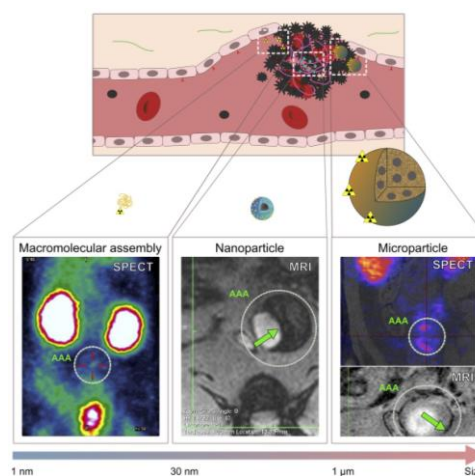
### Tissue Engineering and Molecular Imaging

Didier Letourneur

Cardiovascular Bio-engineering - INSERM U1148 - LVTS  
X. Bichat Hospital, University Paris 7 - Denis Diderot, 75018 Paris  
Institut Galilée, University Paris 13 - Paris Nord, 93430 Villetaneuse, France

This presentation intends to present nanosystems for regenerative medicine and drug delivery systems as well as targeted contrast agents for molecular imaging with an emphasis on cardiovascular pathologies.

We will present examples of innovative nano medical imaging tools. In the context of atherothrombotic diseases, there is a need for new approaches for early diagnosis and improved therapies. This is the focus of NanoAthero, an European large scale project, started in February 2013. The aim is to demonstrate that nanotechnologies can be developed and clinically proven to be effective in tackling cardiovascular diseases. The NanoAthero consortium is a unique opportunity to extend the frontiers of knowledge on atherothrombosis management. NanoAthero aims to demonstrate the preliminary clinical feasibility of the use of nanosystems for targeted imaging and treatment of advanced atherothrombotic disease in humans. NanoAthero combines in-depth knowledge of nanocarrier bioengineering and production with state-of-the-art expertise in imaging and treatment of cardiovascular patients providing a full framework of 16 partners within one collaborative European consortium (16 partners from 10 countries - see <http://www.nanoathero.eu/>).



We will also present how to use nanomaterials for regenerative medicine. Indeed, adhesion by aqueous nanoparticle solutions can be used *in vivo* in rats to achieve rapid and strong closure and healing of deep wounds in skin and liver. Nanoparticles can also be used to fix polymer membranes to tissues even in the presence of blood flow, such as occurring after liver resection, yielding permanent hemostasis within a minute. Furthermore, medical devices and tissue engineering constructs could be fixed to organs such as a beating heart.

#### Some recent references

Suzuki, M., Bachelet-Violette, L., Rouzet, F., Beilvert, A., Autret, G., Maire, M., Menager, C., Louedec, L., Choqueux, C., Saboural, P., Haddad, O., Chauvierre, C., Chaubet, F., Michel, J. B., Serfaty, J. M., and Letourneur, D. (2015) Ultrasmall superparamagnetic iron oxide nanoparticles coated with fucoidan for molecular MRI of intraluminal thrombus. *Nanomedicine*, 10(1):73-87

Varna, M., Juenet, M., Bayles, R., Mazighi, M., Chauvierre, C., Letourneur D. (2015) Nanomedicine as a strategy to fight thrombotic diseases. *Future Science OA* 10.4155/FSO.15.46, 1-14

Silva, A.K., Juenet, M., Meddahi-Pellé, A., and Letourneur, D. (2015) Polysaccharide-based strategies for heart tissue engineering. *Carbohydr Polym* 116, 267-77.

Bonnard, T., Serfaty, J. M., Journe, C., Ho Tin Noe, B., Arnaud, D., Louedec, L., Derkaoui, S. M., Letourneur, D., Chauvierre, C., and Le Visage, C. (2014) Leukocyte mimetic polysaccharide microparticles tracked *in vivo* on activated endothelium and in abdominal aortic aneurysm. *Acta Biomater* 10, 3535-3545

Letourneur, D., Trohopoulos, P. (2014) Atherosclerotic disease and management challenges with nanomedicine: EU FP7 NMP funded "NanoAthero" and "CosmoPHOS-nano" large-scale projects. *Eur J Nanomed* 6(2), 115-119

Bonnard, T., Yang, G., Petiet, A., Ollivier, V., Haddad, O., Arnaud, D., Louedec, L., Bachelet-Violette, L., Derkaoui, S. M., Letourneur, D., Chauvierre, C., and Le Visage, C. (2014) Abdominal aortic

aneurysms targeted by functionalized polysaccharide microparticles: a new tool for SPECT imaging. ***Theranostics*** 4, 592-603

Silva, A. K., Letourneur, D., and Chauvierre, C. (2014) Polysaccharide nanosystems for future progress in cardiovascular pathologies. ***Theranostics*** 4, 579-591

Meddahi-Pelle, A., Legrand, A., Marcellan, A., Louedec, L., Letourneur, D., and Leibler, L. (2014) Organ repair, hemostasis, and in vivo bonding of medical devices by aqueous solutions of nanoparticles. ***Angew Chem Int Ed Engl*** 53, 6369-6373 + Cover

Email : [didier.letourneur@inserm.fr](mailto:didier.letourneur@inserm.fr)