## **Guest Editorial**

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## Cardiovascular nanomedicine

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As a Guest Editor of this special Issue on Cardiovascular Nanomedicine, it is a great pleasure and honor for me to introduce its content in the *European Journal of Nanomedicine*.

First of all, I would like to emphasize the importance of tackling cardiovascular diseases as a public health priority. Earlier diagnoses and ways to improve therapies are urgently required and nanomedicine has the potential to revolutionize current clinical practice.

The data presented in the fourth edition of European Cardiovascular Disease Statistics (1) indicated that cardiovascular diseases (CVD) are the main cause of death in Europe. Diseases of the heart and circulatory system are accounting for over 4 million deaths each year. Nearly half (47%) of all deaths are from CVD and the main forms of CVD are coronary heart disease and stroke. Efforts to reduce mortality from cardiovascular diseases have been successful. However, the cost to the European Union economies of cardiovascular diseases is not decreasing. Overall CVD is estimated to cost the EU economy nearly €200 billion a year.

Cardiovascular diseases (heart attack, heart failure, angina) are diseases of the heart (cardiac muscle) or blood vessels (vasculature). The term heart disease (or coronary heart disease CHD) is used for conditions caused by narrowing of the heart blood vessels (coronary arteries) by atheroma. As a consequence, one of the most important actions to improve human survival and quality of life is the treatment of cardiovascular disease. Pharmaceutical treatments already play a major role in prevention of atherosclerosis and its consequences. At the same time, the use of percutaneous coronary interventions, which improve survival rates after a CHD event, have become more common. Additionally, innovative strategies based on efficacious drugs (nanotherapies), early risk-factor screening, and better follow-up by imaging could contribute to the decline in cardiac morbidity and mortality in the future.

As a team leader in the Cardiovascular Bioengineering Department at Inserm in Paris located inside the Xavier Bichat Hospital, I see the promise of using nanomedicine for cardiovascular diseases. Indeed, nanomedicine is the medical application of nanotechnology, a term used for materials and devices that operate at the nanoscale. In the metric system, the nanosystems are typically measured in nanometers and it encompasses systems whose size is above molecular dimensions and below macroscopic ones (generally >1 nm and few 100 nm). Nanosystems are thus in the same scale of biologic molecules. With their size, nanosystems have high surface area to volume ratios. Additionally, an internal volume is sometimes provided by nanosystems for drugs or imaging agents. Nanosystem encapsulation also enabled controlled release for tuning the delivery rate of the drugs. These are important features of nanosystems that make them particularly wellsuitable as drug delivery carriers or imaging agents in medicine. Nanomedecine also involves the development of systems for imaging, treatment, or both and brings hopes for personalized medicine. Currently, nanotechnology is a fast-moving field gaining support from scientists in the academic, industry, and regulatory/federal sectors. The success of the CLINAM Symposium every year largely demonstrated the interest of this field in Europe. Cardiovascular nanomedicine is likely to face and address current challenges in CVDs. It has to improve detection and therapy and therefore, it may be anticipated that nanomedicine will contribute to improve diagnosis and treatment of cardiovascular diseases.

As a researcher with an engineer background, I see a very promising area of nanomedicine for research, education and industrial developments. The large potential of this field should capture the attention not only of scientists but also of the lay public and authorities. Nanomedicine synergistically cross-fertilizes the fields of chemistry, engineering, biology, and medicine (2) with developments of nanoparticles, nanoscale topography, nanosensors, nanomaterials for tissue regeneration and nanocontrast agents for imaging. In the past decade, nanomedicine has developed a strong multidisciplinary field and the clinical applications seem at reach in cardiology. We are at the beginning to witness the critical stages of industrial and clinical translations for cardiovascular nanomedicine.

You will find in this issue the exciting column "What's up in Cardiovascular Nanomedicine" by Georgette Salieb-Beugelaar.

Iwona Cicha, Christoph Garlichs & Christoph Alexiou from the Experimental Oncology and Nanomedicine Section of University Hospital Erlangen in Germany tell us «Cardiovascular therapy through nanotechnology – How far are we still from bedside?». This review discusses the recent advances in cardiovascular applications of nanotechnologies and highlights the challenges that must be overcome in order to fill the gap existing between the promising bench trials and the successful bedside applications.

The manuscript by Gunter Almer, Peter Opriessnig, Ruth Prassl & Harald Mangge from the Medical University of Graz, BioTechMed-Graz and Institute of Biophysics of Graz in Austria describes the potential of drug candidates for an improved imaging of atherosclerosis lesions in "Anti-inflammatory mediators for molecular imaging of atherosclerosis".

In the current issue, a report from Tel Aviv University in Isreal by Mira Marcus-Kalish & Hamutal Meiri describes "The simultaneous systematic analysis approach for personalized management of cardiovascular diseases", another area in regulatory issues, risk and ethical assessments for efficient and safe monitoring of nanomedecine strategies.

The two 5-year European projects in NMP (Nanosciences, Nanotechnologies, Materials and New Production Technologies), NanoAthero and CosmoPhos-Nano, which began in February 2013, aim to address the issues of clinical translation in cardiovascular nanomedicine. Panagiotis N. Trohopoulos from Thessaloniki in Greece and myself present in the section Perspectives these two large scale EU-FP7 funded projects in "Atherosclerotic Disease and Management Challenges with Nanomedicine".

We hope that this special issue will bring to you new ideas and foster collaborations and fuel further research and developments for industrial and clinical translations. Though still in the very early stages, cardiovascular nanomedicine is likely to meet the high demand for breakthrough innovations and the application of nanotechnology for the diagnosis and treatment of CVDs. In parallel to industrial growth, this is an interesting challenge to bring health benefits to citizens.

## References

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