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**RESEARCH CONFERENCES**

**ESF-UB Conference in Biomedicine**

**Nanomedicine: Reality Now and Soon**

**23-28 October 2010**

**Hotel Eden Roc, Sant Feliu de Guixols, Spain**

**Chaired by:**

Professor Dr. Gert Storm, Utrecht University, The Netherlands

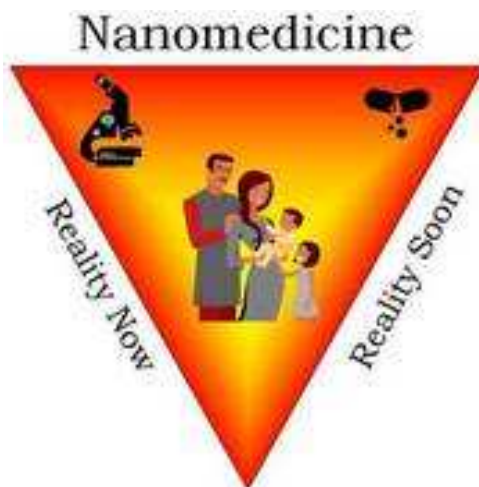
**Organising Committee:**

Dr. Manuel Fuentes, University of Salamanca, Spain  
Professor Dr. Hans Oberleithner, University of Muenster, Germany  
Professor Dr. Fernando Palacio, CSIC - University of Zaragoza, Spain  
Professor Dr David Thomas, University of Cardiff, United Kingdom

**Rapporteur:**

- Twan Lammers, Utrecht University, The Netherlands

[www.esf.org/conferences/10329](http://www.esf.org/conferences/10329)



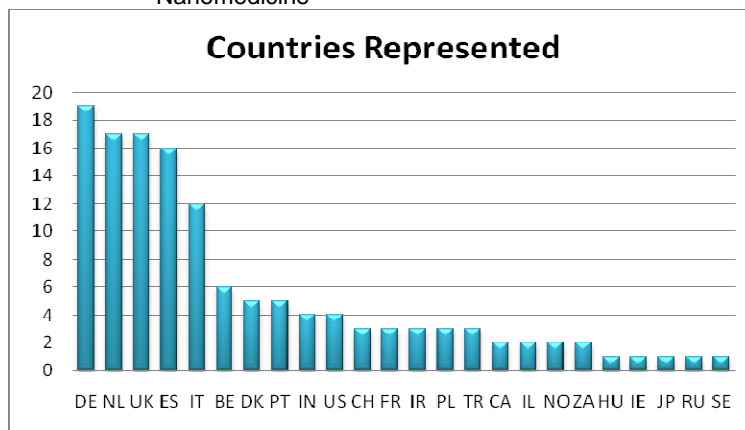
## Conference Highlights

*Please provide a brief summary of the conference and its highlights in non-specialist terms (especially for highly technical subjects) for communication and publicity purposes. (ca. 400-500 words)*

The 3rd ESF-UB Research Conference on “*Nanomedicine*” was the third in a series of biannual in-depth research conferences bringing together academic and industrial scientists. The aim of these conferences is to foster cross-discipline exchange, networking and definition of the state of art in the multi-disciplinary field of 'Nanomedicine' as defined in the ESF Forward Look Nanomedicine. The ultimate goal of this series is to bring together the converging scientific disciplines that enable the timely development of improved diagnostics, biosensors, surgical tools and treatments bringing improved healthcare using nanotechnological approaches. The program of this conference particularly emphasized the clinical utility of those areas of nanomedicine which are close to clinical application, already in clinical development or marketed.

The 2010 conference was chaired by Prof. Gert Storm (Univ Utrecht, Netherlands) supported by Dr. Manuel Fuentes (Univ Salamanca, Spain), and Profs. Hans Oberleithner (Univ Muenster, Germany), Fernando Palacio (Univ Zaragoza, Spain) and David Thomas (Univ Cardiff, UK). Of the 134 delegates attending, 36 participated as speakers or discussion leaders and from the remaining delegates there were 66 posters. In addition to the many senior academics and industrialists who attended 46 younger researchers (from as many countries) were given grants to support their attendance.





The scientific sessions covered a broad range of topics including basic research on innovative nanomaterials, the methods for characterisation of nanostructures and surfaces, and issues dealing with delivery, nanotoxicology and cellular fate. In particular, specific clinical applications were addressed in this third *Nanomedicine* meeting, and the design, industrial development, and clinical use of first generation nanopharmaceuticals, patient imaging agents, biosensors and diagnostics, and systems to promote tissue repair were reviewed. Speakers also discussed the current situation regarding regulatory and ethical aspects of nanomedicine, and mechanisms to ensure engagement of the general public.

Presentation highlights included lectures from experts from academia, and those clinicians and company representatives that described clinical trials showing marketed and new nano-sized systems for the diagnosis, imaging and treatment of cancer, arthritis and other diseases. Whereas the main part of the scientific programme involved lectures in the mornings and evenings, the afternoons were left free for poster sessions networking among scientists. In addition, there were two round-table open-end discussions after the evening sessions dealing with patenting and regulatory issues and flanked by invited experts from industry.

A highlight of the meeting was also the participation of Huub Schellekens (Univ Utrecht), who, in an invited lecture, pinpointed serious problems coming along with pharmaceutical developments including nanomedicine.

This unique challenging, multidisciplinary conference involves many diverse areas but the superb contribution of all delegates ensured the meeting was a landmark success. The follow-up meeting will be the 3rd ESF Summer School in *Nanomedicine* (Halle-Wittenberg, Germany, June 19-24th 2011) for education and training, especially for young clinical scientists.



I hereby authorize ESF – and the conference partners to use the information contained in the above section on ‘Conference Highlights’ in their communication on the scheme.

# Scientific Report

## Executive Summary

(2 pages max)

The ESF Forward Look Nanomedicine (2004 LeBisichenberg) identified a need for truly interdisciplinary meetings bringing together all the constituent disciplines of nanomedicine (in equal proportion), with especially the inclusion of medical doctors to discuss and guide the most urgent medical needs in terms of diagnosis and treatment of disease and those players from academia and industry needed to ensure safe and timely transfer of lab ideas into useful healthcare solutions. This ESF-UB Research Conference series was established to encourage such interdisciplinary exchange via leading edge experts representing each aspect of nanomedicine research and its development and the safe transfer into clinical practice. To ensure lively discussion cross-discipline all delegates and speakers were requested to attend the whole meeting. As required at a Gordon Research Conferences (GRC), it was stressed throughout that there would be no publication of abstracts, photographing or recording of sessions or posters. This ensured open discussion and exchange of the very latest, unpublished data/opinions. This 3rd Research Conference on Nanomedicine built on the reputation of a successful second conference and a successful 2nd ESF Summer School in Nanomedicine held in Lisbon 2009 that was specifically organised as an interactive training programme - lectures, tutorials, debates - for younger researchers and those, academics and industrialists, new to the field.

An overall general review of the meeting scope/participation is provided above. Some specific comments regarding the outcomes are given below:

1. It was agreed that the 2010 meeting created an excellent forum for exchange and debate across all the broad constituent disciplines represented. Many unpublished data were exchanged and details of clinical issues and development and needs were debated. All areas of nanomedicine were represented, guaranteed by the chair (G. Storm: clinical applications of nanodrug-formulations) and the four organizing committee members (M. Fuentes: Nanoproteomics; H. Oberleithner: Nanophysiology; F. Palacio: Nanophysics) and D. Thomas (clinician).

It is recommended for future nanomedicine meetings that the incoming Committee strives hard to ensure equal representation of high level speakers and discussion leaders across all Nanomedicine disciplines from academia and industry, to ensure that discussion is at the highest level in each technical speciality.

2. Compared to other basic (ESF sponsored and other) Research Conferences that focus on some of the basic scientific areas that are now converging in the context of Nanotechnology applied to Medicine, this is the only, open access, high level meeting that is facilitating such a high level debate across all areas in the context of transfer of nanotechnologies from lab to clinic. This uniqueness should be preserved as well as the international participation at the meeting. It was very pleasing note participation from many countries across east and west Europe, and moreover to note the global participation of delegates (- 24 countries represented) from US through Europe to Japan as well as industrial participation.

3. This Research Conference seeks to attract delegates that are globally/nationally recognised, senior experts in each field. Never the less the objective is to ensure 10-20% participation of leading young 'nanomedicine' scientists. In 2010 this goal was achieved via the participation of 68 (<35 years old) younger delegates supported in part using the conference budget and in part through sponsorship kindly donated by the Universities of Barcelona and industrial companies. These young scientists made a significant contribution to the dynamism of the meeting.

4. The Conference successfully adopted a number of information transfer/debate styles that were key to the success of the meeting. Lectures were limited to 35 min with 15 min for discussion of each topic, and the free afternoons & poster sessions gave good time for specific technical exchange and networking. The two evening round-table discussions were well attended, and stimulated lively debate with proposals for the optimum way forward. The participation of a social scientist, who conducted an exercise in parallel with the scientific sessions, was instrumental in generating the creative atmosphere.

## Scientific Content of the Conference

(1 page min.)

- Summary of the conference sessions focusing on the scientific highlights
- Assessment of the results and their potential impact on future research or applications

The scientific sessions of the ESF Conference on "Nanomedicine: Reality Now and Soon" were devoted to Advanced Nanomaterials and Bioanalytics, Nanopharmaceuticals on the market, Nanoimaging, Interactions with the biological milieu, Ligand-mediated targeting, Nanopharmaceuticals in clinical development, Targeted Nanomedicine sponsored by the European Commission, Intracellular delivery of macromolecules, Tissue repair, and Regulatory/Ethical/Societal aspects. Altogether, the invited experts active in nanomedicine research from academia, clinic and industry have given

in-depth lectures on the state-of-the-art (28 lectures in total) including a critical analysis of the likely impact on human healthcare.

Carbon nanotubes, magnetic nanoparticles, quantum dots, gold nanoparticles and nanobodies were among the advanced nanomaterials discussed at the meeting. In addition, specific attention was given to nanomaterials designed to direct stem cell migration/differentiation in neuronal injury. Spotlights were also on nanotechnological tools (like optical and magnetic tweezers, nanopores, AFM) to study biomolecular interactions on the single molecular scale, and the use of ultrasound for triggered drug release and application of nanobiosensors for personalized therapy/diagnostics. Detailed overviews were given on PEGylated proteins, Abraxane and other albumin-based drug formulations and Doxil/Caelyx as prominent nanomedicines being commercially available. Nanopharmaceuticals still in clinical development were represented by polymeric drug conjugates, siRNA-containing nanomedicines and other new anticancer drug formulations (mainly liposome-based). Overall, the presentations on the industrial pharmaceutical formulations were delivering a clear picture and understanding of the real therapeutic value of current nanopharmaceuticals in terms of efficacy and safety. It appears that often the therapeutic index is increased by virtue of improvements at the level of safety while many unknowns are still to be revealed at the level of efficacy. While the majority of nanopharmaceutical applications are still within oncology, it is clear that other disease indications are emerging as reflected by presentations on arthritis and Alzheimer's disease. In addition to drugs, also imaging agents are being associated with nanocarriers, in particular for the purpose of imaging-guided drug delivery. Main highlights in this area were discussed in the Nanoimaging session. The sessions on biological milieu interactions dealt with the challenges of immunogenicity, opsonization and complement activation. Both the role of innate and adaptive immune responses to nanomedicine administration were discussed intensively. One important issue addressed was the benefit of attaching targeting ligands to achieve active targeting of nanomedicines, with the benefit being dependent on the accessibility and nature of the target cells to be reached in the body. Intracellular delivery and trafficking studies are of crucial value for achieving efficient drug delivery at the cellular level, in particular for the delivery of macromolecular drugs such as nucleic acids (DNA, siRNA) and antigens (vaccins). As examples of intracellular barriers, the focus was particularly on the passage over endosomal membranes and nuclear entry of DNA via the nuclear pore complex. The session before the last closing session was on the challenges of tissue repair in man and practical applications of nanomedicine which had been taken from concept to clinical practice in the treatment of wounds and the management of bacterial infections. The tissue repair session additionally discussed the role of nanospheres in antimicrobial therapies and detailed how understanding of the nanoscale interactions between bacteria and cells and the underlying extracellular matrix could mediate both adhesion and biological response in vivo. Finally, regulatory and societal aspects associated with the used on nanomedicines were addressed in the "Closing the scene" session.

In addition to the main lectures described above, there was a special guest lecture on the issues associated with the development of nanomedicines while nowadays pharmaceutical innovation is in a serious crisis. Also, 21 short talks were given by mostly young and early stage researchers on a broad spectrum of topic fitting within the session themes and which were selected on the basis of submitted abstracts.

Furthermore, there were two round-table discussions organized after the evening sessions, one dealing with the hurdles to be faced when developing nanomaterials for biomedical applications, and the other with a specific focus on the management of the research translation process. There were two Round-Table (RT) discussions. The first focused on *Developing nanomaterials for biomedical applications: problems and pitfalls* and discussed a variety of problems related to nanosafety and general issues on materials design. The RT was chaired by F. Palacio started with a presentation from Dr. Carlos Buesa, CEO of Oryzon Genomics a Biotech Company and Conference sponsor. The second RT was titled *From the laboratory to the patent and then to the patient: managing the process of research translation*. In this interactive session D. Thomas was joined by Arne Dessen who is Executive Officer of a Biopharma company AlgiPharma AS who had taken many compounds and chemical entities from the lab to products and the clinic. In the discussion much was made of the future of research translation and different, innovative funding models from around the world were discussed which could facilitate this process in a time of economic restraint in the European Community.

66 posters, presented during 4 specific poster sessions but displayed during the whole duration of the meeting, completed the extensive scientific landscape of this nanomedicine conference. Based on votes given by all speakers of the conference, 4 poster awards were given:

- 1<sup>st</sup> prize of 300 EUR was given to Kumar Penmetcha, National Institute of Advanced Industrial Science and Technology (AIST), JP, on "Analyses of various biomolecular interactions using spinning-multilayered disk biosensor".
- 2<sup>nd</sup> prize of 200 EUR was given to Rose Hayeshi, Council of Scientific and Industrial Research, ZA, on "Evaluation of polymeric nano drug delivery systems for the treatment of TB".
- 3<sup>rd</sup> prize of 100 EUR was given to Maria Jara-Acevedo, Servicio de Citometría, Centro de Investigación del Cáncer, ES, on "Nanotechnology Approaches For High-Throughput Determination Of Small Kinase Inhibitors Activity On Ckit".

4<sup>th</sup> prize of 100 EUR was given to Anna Meyring, University of Muenster, DE, on "Atomic force microscopy reveals non-selective gating of the nuclear barrier".

The final meeting programme can be found at <http://www.esf.org/conferences/10329>

Some final remarks:

The scientific exchanges will undoubtedly foster new collaborations (feedback from the 2nd meeting in 2008 underlined the success of this networking). The open access nature of the meeting is unique.

Although some countries are better catered for than others, an ongoing need for advanced training bringing clinicians closer to the basic scientific opportunities and also encouraging basic scientists to gain access to the real clinical needs was discussed. The ESF Research Conference and Summer School on Nanomedicine make an important contribution to inter-disciplinary (incl. clinical) debate and training respectively.

The continuing needs for better integrated development of proactive risk management and regulatory assessment for "Nano" was noted during the Conference.

## Forward Look

(1 page min.)

- *Assessment of the results*
- *Contribution to the future direction of the field – identification of issues in the 5-10 years & timeframe*
- *Identification of emerging topics*

The ESF Forward Look Nanomedicine was initiated by EMRC in 2003 and the final report published 2005. This landmark document, ratified by debate at an open Consensus Conference held in Le Bischenberg, near Strasbourg in 2005, was the first comprehensive review worldwide to set the scene for Nanomedicine Policy and Needs.

The document and its recommendations have been widely used by the EC (European Technology Platform Nanomedicine) and specific National Member policy/funding agencies to guide their funding policy in the Nanomedicine Area.

This Conference is itself an output from the FL Nanomedicine in terms of its recommendation for 'truly interdisciplinary meetings'. The summer schools are providing advanced, integrated medical training.

- *Is there a need for a foresight-type initiative?*

## Atmosphere and Infrastructure

- *The reaction of the participants to the location and the organization, including networking, and any other relevant comments*

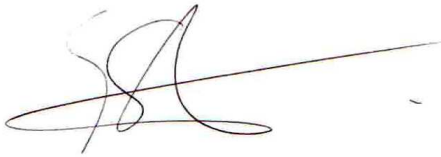
The meeting created an excellent atmosphere for exchange-this was due in large part due to the participation, breadth of background and openness of the delegates, but was also aided by the timetable and tactics used by the chair of the meeting (programme timetable) and also the pleasant venue.

The "Evaluation Questionnaire Results" give overall a positive assessment of the quality of the meeting.

**Date & Author:**

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Gert Storm, 30 November 2010

A handwritten signature in black ink, appearing to be 'Gert Storm', written over a horizontal line.