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Preface

Biological barriers – A need for novel tools in nanotoxicology and nanomedicine

The present special issue of EJPB compiles some selected papers presented at the 8th International Conference and Workshop "Biological Barriers – in vitro Tools in Nanotoxicology and Nanomedicine", which took place from 21 March to 1 April 2010 at Saarland University, Saarbrücken, Germany. Organized again under the auspices of the GALENOS Network (www.galenos.net), the conference program this time also featured some training courses of the European large scale research project "MediTrans" on nanomedicines as well as a complementary workshop on scientific writing and publishing in collaboration with Elsevier BV. One day of the program was specifically dedicated to new polymers and particles for advanced drug delivery, and was organized in collaboration with the CRS Local Chapter Germany.

Nanotoxicology is primarily addressing the safety or potential risks of new nanoscale materials, such as e.g. metal oxides, quantum dots or carbon nanotubes. Mostly, these new materials have not been primarily developed for an application as pharmaceutical or medical products, but for technical applications or devices, such as e.g. easy-to-clean surfaces, car tires, brakes or tennis rackets. Therefore, biocompatibility and toxicological properties were not a priori in the focus of the research for such new functional materials. Moreover, due to their chemical properties and application needs, these nanomaterials are typically bioresistant rather than biodegradable. Nevertheless, consumers and society are asking questions regarding the safety of such materials when released into the environment or brought in contact with, if not internalized by the human body. Endpoints of studies to address those concerns are their acute, genetic or environmental toxicity, body distribution and elimination. In particular ADME properties of nanoscale materials, like other xenobiotics, are essentially relating to the question if and to what extent they might be able to cross biological barriers, such as e.g. the skin, the intestinal or pulmonary mucosa.

The same question, however, is also a very central one when it comes to developing new nanomedicines, i.e. nanotechnology-based pharmaceutical products or diagnostics. Also here safety – besides efficacy – is the first question being raised due to the very strict international regulations of drugs and medicinal products. Therefore, materials, which have already been demonstrated to be safe in "non-nano" medicines, are preferred. Moreover, biodegradable materials are often preferred over bioresistant materials as they can be better eliminated from the body, avoiding risks of accumulation and long term toxicity. However, the safety of nanomedicines needs to be demonstrated, typically in vivo and ultimately by clinical studies.

Methods to evaluate and predict the biological effects of new nanomaterials and nanomedicines in an early stage of their development by contemporary in vitro or in silico approaches are highly demanded. The faster translation of new concepts for targeted drug delivery into the clinic is a most important driver for the research on such methods as is the avoidance of animal experiments, which are even prohibited in the case of some non-medical products.

Regardless of the fact that the preferred answers and optimization strategies might be different or even be quite in contrast – e.g. hopefully rapid and complete passage across the intestinal mucosa for some oral drug nanocarriers vs. hopefully no penetration of the skin or other epithelial barriers for some nanoparticles to be used in cosmetics – the central scientific questions in nanotoxicology and nanomedicine are essentially very similar. Both fields of science are addressing the interaction with biological barriers and in this context require new and better predictive in vitro models than the existing ones. In addition, analytical methods are needed to characterize the physicochemical properties of either kind of nanomaterials when in contact with biological liquids, such as blood, chymus or alveolar lining fluids.

As editor of EJPB and organizer of "Biological Barriers 2010" I wish to thank all the speakers, teachers and participants of this event, and I specially thank the contributors of the papers of this special issue. Like in regular issues, they all underwent a rigorous peer review as an absolute must.

Finally, by the time this special appears, the next "Biological Barriers 2012" is already looking round the corner and is scheduled for 29 February to 9 March 2012. For details of the program and registration visit http://www.uni-saarland.de/biobarriers2012.

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