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Biological Barriers – Advanced Drug Delivery, *In vitro* Modelling, and their Implications for Infection Research

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The topic of “Biological Barriers” is still as relevant as it has been in the beginning when the conference was established in 1997. Almost 20 years later, and after a biannual rhythm has turned out to work best, this conference and workshop has been proud to celebrate its 10th edition in February 2014. Although many new approaches, materials and ideas have been described since our first meeting, many open questions have still not yet been sufficiently answered.

In particular, improvements of analytical methods including high resolution imaging are always needed. This also holds true for the trend to combine different techniques with each other to obtain complementary information during the analysis of the same sample.

Successful examples are confocal Raman microscopy providing chemical sensitivity and label-free imaging in combination with topographical analysis as well as the comparison of methods such as electron microscopy and fluorescence microscopy for studying the kinetics of phagocytotic processes. Advanced microscopy methods ideally allow to visualize both, the respective biological barriers, as well as the drug carriers and eventually also their transport across and possible effects exerted to the barrier.

The effect of carrier materials and systems on the barrier by changing its natural environment, or the interaction with the barrier with respect to uptake or penetration was in the focus of this year’s meeting. This comprised different application routes and hence epithelial barriers, also including non-cellular barriers such as mucus and surfactant. With the foundation of HIPS (Helmholtz Institute for Pharmaceutical Research Saarland) as a part of HZI (Helmholtz Center for Infection Research, Braunschweig, Germany), bacterial barriers, such as their cell envelopes and biofilm formation have also moved into our focus, broadening the overall concept of biological barriers. Thus, new and different requirements for the specific interactions with all these barriers pose new challenges for advanced drug delivery systems. Furthermore, a key is the presence of these barriers in close vicinity to each other, which

needs a meaningful combination of the materials' and carriers systems' properties to address the different hurdles and to overcome the barriers safely, but efficaciously. This combined demand on advanced drug delivery systems further increases the level of complexity and necessitates smarter and flexible system responding to environmental needs.

In this context, the development of relevant *in vitro* models of biological barriers is gaining more and more momentum in terms of a simplistic representation of the real situation facilitating high throughput screening of substances but also in terms of a reduction of necessary *in vivo* experiments. Combinations of different cell types to mimic the relevant players, the addition of additional barriers such as mucus are investigated to improve the understanding and the predictive potential. In addition, models representing the healthy and the disease state are under investigation to cover all necessary characteristics for a future application.

The organizers of "Biological Barriers 2014" wish to thank all the participants which made this event a success due to their contribution. Especially, we thank the authors contributing to this special issue allowing to get a glimpse on relevant research topics around biological barriers. Like for all regular issues, they had to pass a rigorous peer reviewing process before acceptance.

Finally, by the time this special appears, the next conference "Biological Barriers 2016" is being organized and scheduled for March 7th – March 9th bringing a broad scientific audience together. To enforce close interaction and a large scope, the conference organization involves several scientific societies and non-profit organisations synergistically. The 11th meeting in 2016 offers a common platform to CRS Local Chapter, Galenus Foundation, CAAT Europe Foundation for alternatives to animal testing, the PathChooser EU consortium and Catalent. For details of the program and registration visit <http://www.uni-saarland.de/biobarriers2016>.