FS 101

Status and perspectives of NanoBioMedicine in Germany and Europe

Klaus-Michael Weltring, Geschäftsführung, Gesellschaft für Bioanalytik Münster e. V., Münster, Deutschland, weltring@bioanalytik-muenster.de

Nanotechnology is one of the Key Enabling Technologies (KET) for the development of new and especially personalised products for diagnosis and therapy of many diseases. In this very interdisciplinary field, called NanoBioMedicine, not only close collaboration of chemists, physicists, biologists and engineers is necessary but also an intense dialogue between industry and regulators to bring safe and efficacious nanobiomedicines to patients. The interaction of such diverse stakeholders requires an intense communication, which is enabled and managed by the German platform for NanoBioMedizin.
The aim of the platform founded by 90 representatives from research organisations, industry and government agencies in 2015 is to bring results of nanobiomedical research faster and more efficiently to the patient. The means to achieve this are described by the members in a position paper and action plan. Both papers detail the R&D topics and structural requirements for a dynamic development of NanoBioMedicine in Germany and put them into perspective with the strategic research and innovation agenda of the European Technology Platform Nanomedicine. The presentation will highlight the trends described in these papers.

FS 102

Cell transplantation in lumbar spine disc degeneration disease

H. J. Meisel, Department of Neurosurgery, BG Klinikum Bergmannstrost, Halle a. d. S., Deutschland
C. Hohaus, Department of Neurosurgery, Städtisches Klinikum Dessau, Dessau, Deutschland
Y. Minkus, Department of Neurosurgery, BG Klinikum Bergmannstrost, Halle a. d. S., Deutschland
T. Ganey, Atlanta Medical Center, Atlanta, Vereinigte Staaten von Amerika

Introduction: Low back pain is an extremely common symptom, affecting nearly three-quarters of the population sometime in their life. Given that disc herniation is thought to be an extension of progressive disc degeneration that attends the normal aging process, seeking an effective therapy that staves off disc degeneration has been considered a logical attempt to reduce back pain. The most apparent cellular and biochemical changes attributable to degeneration include a decrease in cell density in the disc that is accompanied by a reduction in synthesis of cartilage-specific extracellular matrix components. With this in mind, one therapeutic strategy would be to replace, regenerate, or augment the intervertebral disc cell population, with a goal of correcting matrix insufficiencies and restoring normal segment biomechanics. Biological restoration through the use of autologous disc chondrocyte transplantation offers a potential to achieve functional integration of disc metabolism and mechanics.
Methods: We designed an animal study using the dog as our model to investigate this hypothesis by transplantation of autologous disc-derived chondrocytes into degenerated intervertebral discs. As a result we demonstrated that disc cells remained viable after transplantation; transplanted disc cells produced an extracellular matrix that contained components similar to normal intervertebral disc tissue; a statistically significant correlation between transplanting cells and retention of disc height could displayed.
Results: Following these results the Euro Disc Randomized Trial was initiated to embrace a representative patient group with persistent symptoms that had not responded to conservative treatment where an indication for surgical treatment was given. In the interim analyses we evaluated that patients who received autologous disc cell transplantation had greater pain reduction at 2 years compared with patients who did not receive cells following their discectomy surgery and discs in patients that received cells demonstrated a significant difference as a group in the fluid content of their treated disc when compared to control.
Discussion: Autologous disc-derived cell transplantation is technically feasible and biologically relevant to repairing disc damage and retarding disc degeneration. Adipose tissue provides an alternative source of regenerative cells with little donor site morbidity. These regenerative cells are able to differentiate into a nucleus pulposus-like phenotype when exposed to environmental factors similar to disc, and offer the inherent advantage of availability without the need for transporting, culturing, and expanding the cells. In an effort to develop a clinical option for cell placement and assess the response of the cells to the post-surgical milieu, adipose-derived cells were collected, concentrated, and transplanted under fluoroscopic guidance directly into a surgically damaged disc using our dog model. This study provides evidence that cells harvested from adipose tissue might offer a reliable source of regenerative potential capable of bio-restitution.
References:
Ganey T, Libera J, Moos V, Alasevic O, Fritsch KG, Meisel HJ, Hutton WC. Disc chondrocyte transplantation in a canine model: a treatment for degenerated or damaged intervertebral disc. Spine. 2003;28:2609–2620. doi: 10.1097/01.BRS.0000097891.63063.78.
Ganey TM, Meisel HJ. A potential role for cell-based therapeutics in the treatment of intervertebral disc herniation. Eur Spine J. 2002;11(Suppl 2):S206–S214.

FS 103

Challenges in the drug release testing of Nanomedicines

Mukul Ashtikar, Project group for Translational Medicine & Pharmacology, Fraunhofer Institute for Molecular Biology and Applied Ecology, Frankfurt a. M., Deutschland, ashtikar@em.uni-frankfurt.de
Mangal Nagarsenkar, Bombay College of Pharmacy, Department of Pharmaceutics, Santacruz East, Mumbai, Indirn
Matthias Wacker, Fraunhofer Institute for Molecular Biology and Applied Ecology, Project group for Translational Medicine & Pharmacology, Goethe University, Institute of Pharmaceutical Technology, Frankfurt a. M., Deutschland

Despite the tremendous advances in drug delivery, the limitations of the analytical technologies involved in the characterization of nanomedicines are impeding further progress of an emerging market. Discriminating the drug release profile between different formulations is one of the most important quality criteria in development and quality control of pharmaceuticals and biopharmaceuticals. Unfortunately, there are only few methods available to sensitively measure this important parameter for nano-sized carriers. The wide range of materials and formulations used in drug therapy also requires different approaches for various types of formulations. Currently, there are several methods available for the release testing of orally administered nanocrystal formulations. In many of these, sampling procedures entail a risk of disrupting the carrier structure resulting in a more rapid drug release. Other technologies relying on dialysis are of limited sensitivity and do not discriminate well between different formulations or batch qualities. In this context, the barrier properties of the dialysis membrane are rate limiting to the drug released from carrier system. With the development of the dispersion releaser technology, a novel dialysis-based technique will come into market. In future, it may be used to support formulation development with a more reliable methodology to improve nanotechnology based products.

FS 105

On the road to biomimetic implants by additive manufacturing using functional organic materials

Günter Tovar, Institut für Grenzflächenverfahrenstechnik und Plasmatechnologie IGVP, Universität Stuttgart, Stuttgart, Deutschland, guenter.tovar@igb.fraunhofer.de
Kirsten Borchers, Institut für Grenzflächenverfahrenstechnik und Plasmatechnologie IGVP, Universität Stuttgart, Stuttgart, Deutschland
Lisa Sewald, Institut für Grenzflächenverfahrenstechnik und Plasmatechnologie IGVP, Universität Stuttgart, Stuttgart, Deutschland
Alexander Southan, Institut für Grenzflächenverfahrenstechnik und Plasmatechnologie IGVP, Universität Stuttgart, Stuttgart, Deutschland

Biomimetic implants would mimick natural structures by their design as well as by their chemical composition. Shape forming of objects by additive manufacturing is possible for a variety of metallic and ceramic materials as well as for a number of soft matter systems. Our goal is to widen the path to use functional organic materials in order to create biomimetic structures and surfaces for the design of functional implants. Therefore, complex polymer based systems are being developed that are well suited to be shaped by additive manufacturing. The materials have to match the technical needs of the process and at the same time the needs of biocompatibility and biofunction. They should form artificial structures that mimick natural body parts. We present an approach towards creating artificial articular cartilage and artificial vascular structures.