

ENCITE – A peek into the future of cell imaging Outstanding scientific findings after the second project year Vienna, 28 July 2010

ENCITE – a multidisciplinary challenging project

The consortium of the project “European Network for Cell Imaging and Tracking Expertise” (ENCITE) has the ambitious mission to develop and test new MR and optical imaging methods and biomarkers to draw a more comprehensive picture of cell fate and the reaction of the immune system. In the end cell therapy shall be improved for the benefit of the European patient.

Interim results

Novel imaging technologies: Key methodologies for cell tracking were developed and optimised, including imaging methods for specific contrast agents and new biomarkers to monitor cell fate, and meaningful integration and post-processing of imaging data, including molecular, functional, and anatomical data. MR-based cell tracking was implemented, and methods for preclinical drug evaluation were optimised. 3D and 4D MRI datasets from brain and heart, generated under various (contrast) conditions, form the backbone of the new, publicly available mouse and rat atlases.

Novel imaging reporter probes: High-relaxivity, Gd-based probes and Gd-loaded nanosystems were developed and tested. MRI detectability was assessed in vitro. A Gd-based platform responsive to enzyme activity and thus gene expression was developed. As a start towards targeting, a process to coat gram-amounts of iron oxide particles for use in binding was developed. Constructs with optical and MRI reporter genes were developed. Bicistronic vector was generated and introduced into embryonic stem cells. CMV-HA-ferritin-IRES-fLuc was stably expressed in a human glioblastoma line (Fig.1 illustration).

Novel tools for cell labeling: Protocols for cell labeling were established. Tailored protocols for specific cells and specific contrast media proved necessary, as was expected (report period 1). Use of reporter probes for monitoring cell differentiation and programmed cell death proved to be feasible in animal models. Evaluation of the potential for in vivo, clinical imaging of cell fate and cell death is in progress.

Pre-clinical validation: Novel ¹⁹F- and Gd-based probes and MRS techniques improved monitoring of neuronal stem cell fate and tissue repair in stroke models. New MR acquisition and image processing techniques gave sensitive, quantitative detection of labeled cells in the heart. Biomarkers for intervertebral disc and cartilage degeneration were defined using e.g. double quantum filtered MRI and multinuclear NMR. A new dual-modality probe was successful in pancreatic cell labeling experiments; also, a positive contrast technique for iron oxide particles was developed. New methods to track the fate and interactions of dendritic and NK cells were validated using multiphoton microscopy, PET imaging, and MR spectroscopy. Detailed analysis of T-cell effector functions was made possible by new methods to monitor tumor cell nuclear states. A robust, spontaneous, orthotopic prostate cancer model was developed in transgenic mice. Finally, optical techniques to monitor tumor cell-T cell interactions and apoptosis were developed.

Translation towards clinical applications: Translation towards clinical cancer applications started with establishment of an infrastructure for the production of tracers. Regarding diabetes, 8 patients with labeled pancreatic islets were examined according to the developed protocol (45 examinations).

Expected final results and their potential impact and use

ENCITE birthed an extensive network for development and implementation of novel imaging tools in the field of cellular therapy. The ultimate goal is (image-guided) cellular therapy in widespread clinical use, offering potential cure for many diseases, including cancer and infectious diseases.

Given the results achieved in the first two years, ENCITE’s goal is within reach. The spectrum of applications spans the scientific process, embodying translational research. The toolbox can be adapted to new studies. Results obtained in the field of novel imaging reporter probes and cell labeling procedures are extremely encouraging.



The imaging tools developed should improve monitoring of cell therapy and improve the understanding of the fate of transplanted cells and the mechanism of action of cell-based therapies. Using the knowledge obtained in these studies, tools and treatment strategies can be further optimised to reap the full benefit of cell-based therapies.

For details on the findings please look at the references and contact: office@eibir.org

ENCITE is a four year project co-funded by the European Commission under the 7th Framework Programme and co-ordinated by the European Institute for Biomedical Imaging Research (EIBIR). It started in June 2008 and consists of 29 international scientific partners from ten countries with outstanding expertise in cell imaging and tracking.