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Monitoring the kinetics of therapeutic T cells non-invasively by positron emission tomography imaging

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Kinetics of therapeutic cells can be monitored during cell therapy in all mammals including humans using positron emission tomography (PET) molecular imaging. Kinetics monitoring can include detecting the whole-body presence and quantity of cells, locations of accumulation within the whole-body, quantity accumulated at each location, cell survival, cell proliferation, changes in cell characteristics and functionalization of therapeutic cells. All of these kinetics parameters can theoretically be monitored using PET reporter gene/probe (PRG/PRP) systems. In the past 12-15 years PRG/PRP systems have been used to image biodistribution of a variety of cells, including immune cells, stem cells, cancer cells, and pancreatic islet cells in research animals. In 2006, for the first time we demonstrated imaging cells with a reporter gene system in humans. Genetically engineered autologous human T cells stably expressing the PRG/suicide gene Herpes Simplex virus type 1 thymidine kinase were imaged after injection into the brain of a glioblastoma cancer patient and the PET image even demonstrated trafficking of the cells from the injection site to a recurrent tumor in the corpus callosum of the patient. We are now developing human derived PRGs that will potentially solve the problem of immunogenicity toward the protein encoded by the PRG; thus they should be safer to use in clinical cell therapy trials. Finally, we have developed a new PET probe, Fluorine-18 radiolabeled 9-β-$_{D}$-arabinofuranosylguanine ([^{18}F]F-AraG), that can be used to image activated T cells. Therefore, [^{18}F]F-AraG should be useful for detecting the whole-body biodistribution of therapeutic T cells upon activation

Biography

Shahriar Yaghoubi completed his Ph.D in Molecular and Medical Pharmacology from UCLA in 2002 with specialization in gene imaging. He then completed a 2 year postdoctoral fellowship in cell therapy and imaging at Stanford University. He obtained the first IND approval for a PET reporter probe from FDA and performed the first ever reporter gene based imaging of cells in humans. He is a co-editor of the only book on imaging with reporter genes and author of 25 peer-reviewed articles. He is currently the Chief Scientific Officer of CellSight Technologies, Inc. and a visiting professor at UCLA School of Medicine

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