

Chemistry of Contrast Media

Biologicals

How to Introduce Reporter Genes in Cells

Christophe M. Deroose

Nuclear Medicine, UZ Leuven, Leuven, Belgium; Imaging & Pathology, KU Leuven, Leuven, Belgium

Learning Objectives:

- Knowing the different molecular biology strategies to introduce reporter genes into cells
- Recognizing the advantages and weaknesses of these different strategies
- Critical appraisal of strategies to express more than one single gene
- Influence of introduction route on signal quantification

This session will focus on the different techniques available to introduce imaging reporter genes in cells, both in vitro and in vivo. Techniques discussed will include plasmid transfection, viral vectors (retro, adeno, lenti and addeno-associated) and gene locus targeting strategies. An overview will also be provided on techniques to couple reporter gene expression to expression of a gene of interest (therapeutic or disease inducing). We will further look into the quantitative aspects of reporter gene imaging and on those aspects of the gene introduction strategy on signal quantification. Finally, we will discuss how reporter gene imaging can be used to monitor gene therapy.

Relevant Publications:

1. Wolfs E, Struys T, Notelaers T, Roberts SJ, Sohni A, Bormans G, Van Laere K, Luyten FP, Gheysens O, Lambrechts I, Verfaillie CM, Deroose CM. 18F-FDG Labeling of mesenchymal stem cells and multipotent adult progenitor cells for PET imaging : effects on ultrastructure and differentiation capacity. *Journal of Nuclear Medicine* 2013 Mar;54(3):447-54
2. Deroose C, Chitneni S, Gijsbers R, Vermaelen P, Ibrahim A, Balzarini J, Baekelandt V, Verbruggen A, Nuyts J, Debyser Z, Bormans G, Mortelmans L. Preliminary Validation of Varicella Zoster Virus Thymidine Kinase as a Novel Reporter Gene for PET *Nuclear Medicine and Biology*.2012 Nov;39(8):1266-74
3. Gheysens O, Chen I, Rodriguez-Porcel M, Chan C, Rasooly J, Vaerenberg C, Paulmurugan R, Willmann J, Deroose C, Wu J, Gambhir S. Non-invasive Bioluminescence Imaging of Myoblast Mediated Hypoxia-Inducible Factor-1 Alpha Gene Transfer. *Molecular Imaging and Biology*, 2011; 13(6), 1124-1132
4. Vandeputte C, Evens N, Toelen J, Deroose CM, Bosier B, Ibrahim A, Van der Perren A, Gijsbers R, Janssen P, Lambert D, Verbruggen A, Debyser Z, Bormans G, Baekelandt V, Van Laere K. A PET Brain Reporter Gene System Based on Type 2 Cannabinoid Receptors. *Journal of Nuclear Medicine* 2011, 52(7); 11.02-1109
5. Ibrahim A, Vande Velde G, Reumers V, Toelen J, Thiry I, Vandeputte C, Deroose C, Bormans G, Baekelandt V, Debyser Z, Gijsbers R: Highly efficient multicistronic lentivectors with peptide 2A sequences. *Human Gene Therapy* 2009 Aug;20(8):845-60
6. Deroose CM, Reumers V, Debyser Z, Baekelandt V: Seeing genes at work in the living brain with non-invasive molecular imaging. *Current Gene Therapy* 2009; 9(3):212-38.

7. Reumers V, Deroose CM, Gijssbers R, Krylychkina O, Geraerts M, Mortelmans L, Debyser Z, Baekelandt V: Noninvasive and quantitative monitoring of adult neuronal stem cell migration in mouse brain using bioluminescence imaging, *Stem Cells* 2008;26(9):2382-90
8. Deroose CM, De A, Loening AM, Chow PL, Ray P, Chatziioannou AF, Gambhir SS: Multimodality imaging of tumor xenografts and metastasis in mice with combined microPET, microCT and bioluminescence imaging, *Journal of Nuclear Medicine*, 2007;48(2):295-303.
9. Deroose CM, Reumers V, Gijssbers R, Bormans G, Debyser Z, Mortelmans L, Baekelandt V: Non-invasive monitoring of long-term lentiviral vector-mediated gene expression in rodent brain with bioluminescence imaging, *Molecular Therapy*, 2006; 14(3):423-31.

Disclosure of author financial interest or relationships: C.M. Deroose, None.