Macrophage tracking using multi-modality 3D imaging in xenografts
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Abstract
A common approach to immunotherapy is to promote the accumulation of specific bone marrow-derived myeloid cells into tumors for anti-tumor activity. While the pro-anti-tumor effects of differentiated myeloid cells are complex, several novel therapeutic approaches are focused on recruiting macrophages to tumors and transforming their pro-tumor phenotypes of macrophages to anti-tumor phenotypes.

Methods
Research efforts to better understand and manipulate this type of macrophage biology are critical for developing and testing therapeutics. These experimental models commonly utilize imaging approaches, such as in vivo molecular imaging or histological approaches to visualize macrophages in the context of tumors. These imaging modalities provide different advantages in their ability to characterize macrophage distribution, tissue localization and kinetics. In vivo imaging, such as MRI and fluorescence imaging provide strong temporal insights and general distribution in target tissues, but are limited by sensitivity and resolution. Fluorescence microscopy and histology provide substantially higher resolution and sensitivity regarding tumor-associated macrophages (TAM) localization and cellular morphology, but lack temporal resolution and only samples a small portion of target tissue. Cytofluorescence tomography (CFT) is an attractive new modality in which an entire animal or tissue can be imaged in 3D with high-resolution and increased sensitivity compared to nuclear in vivo imaging approaches.

Results
We conducted a multi-modality imaging study using V-Sense, a perfluorocarbon compound that is dual labeled with 19F and Cy7, and was shown to preferentially be uptaken by macrophages in vivo (Khurana et al. 2018). The results of this study demonstrate the added value of a multi-modality imaging approach using V-Sense, in which low resolution in vivo imaging and high-resolution 3D CFT imaging can complement each other, providing rich, multi-resolution layers of immunological information in the same subjects. Here, we provide a POC using V-Sense, a 19F, Cy7 dual-labeled compound. MRI and IVIS were conducted to gain spatio-temporal information, while CFT was conducted to complement the low resolution of MRI and IVIS and to increase the sensitivity.

Discussion
We conducted a multi-modality imaging study using V-Sense, a perfluorocarbon compound that is dual labeled with 19F and Cy7, and was shown to preferentially be uptaken by macrophages in vivo (Khurana et al. 2018). The results of this study demonstrate the added value of a multi-modality imaging approach using V-Sense, in which low resolution in vivo imaging and high-resolution 3D CFT imaging can complement each other, providing rich, multi-resolution layers of immunological information in the same subjects. Here, we provide a POC using V-Sense, a 19F, Cy7 dual-labeled compound. MRI and IVIS were conducted to gain spatio-temporal information, while CFT was conducted to complement the low resolution of MRI and IVIS and to increase the sensitivity.

References
Ahrens et al. [BioTechniques. 2011 April, 50:229-234]