

# Near-Infrared Dye with Large Stokes Shift for Simultaneous Multichannel *in vivo* Molecular Imaging

## Summary

Fluorescent labels having near-infrared (NIR) emission wavelengths have the ability to penetrate tissue deeper than other emission wavelengths, providing enormous potential for non-invasive imaging applications. Vanderbilt researchers have developed a novel NIR dye (4-Sulfonir) for multichannel imaging that enables *in vivo* imaging of multiple targets due to its large Stokes shift. 4-Sulfonir with its unique large Stokes shift and wide excitation spectrum could be used in parallel with other NIR dyes for imaging two molecular events simultaneously in one target.

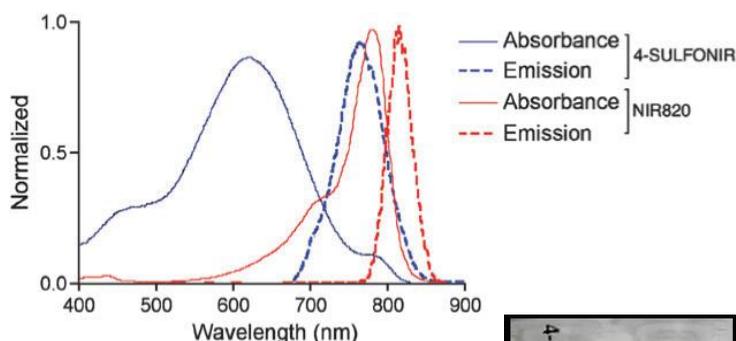
## Addressed Need

- » High scattering effects of different types of biological tissues make optical imaging very difficult, as it is near impossible to differentiate signal from background signal
- » The Stokes shift (difference in absorbed and emitted wavelength) of most NIR dyes is very narrow
- » Because of the broad, overlapping peaks, and the typically narrow Stokes shift, it is difficult to isolate the emitted wavelength (signal) from the excitation wavelength and other noise
- » Advancement of optical imaging (particularly NIR imaging) is hindered by the limitation of narrow Stokes shift of most infrared dyes currently available in the market

## Technology Description

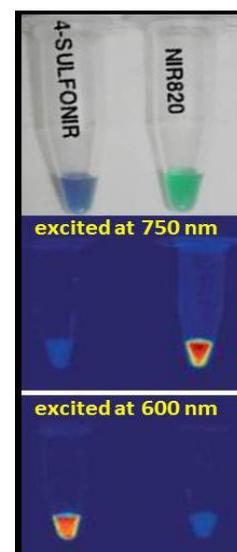
This novel NIR dye has the ability to generate a large Stokes shift, of an impressive 150nm, that allows for more reliable detection of the imaging target. Furthermore, this new dye contains a very wide excitation spectrum allowing excitation in the visible spectrum while the emissions spectrum is registered in the infrared, making the emissions signal easily distinguishable from the excitation noise. These two vital features allows for the imaging of several molecular events at once using different wavelengths within the wide excitation range, while also providing a clear, readable signal.

## 4-Sulfonir (Blue) has a unique large stokes shift of ~150nm



## Differential imaging of two near-infrared dyes in one environment gating at different excitation channels:

4-Sulfonir with its unique large Stokes shift, could be used in parallel with other NIR dyes for imaging two molecular events simultaneously in one target. When the dyes were excited in the NIR channel (700–850 nm), NIR820 emitted a significant stronger fluorescent signal (emission 780–950 nm) than 4-Sulfonir. However, upon switching excitation to visible light (500–620 nm), under the same settings, 4-Sulfonir illuminated with remarkable intensity in the NIR region. (Pham et al., 2008, Notling et al, 2011)



## Unique Properties

- » 4-Sulfonir is stable, water-soluble & bioconjugatable
- » Synthesis of 4-Sulfonir is cost-effective and time efficient

## Intellectual Property Status

- » US Patent [8,168,804](#) issued on 5/1/2012
- » US Divisional patent application pending
- » Pham et al., A Near-Infrared Dye for Multichannel Imaging. *Chem Commun.* 16, 1895-1897, 2008
- » Notling et al., Near-Infrared dyes: Probe Development and Applications in Optical Molecular Imaging. *Curr Org Synth.* 2011; 8(4): 521-534.

### CTTC CONTACT:

Masood Machingal, Ph.D.  
Phone: (615) 343-3548  
masood.machingal@vanderbilt.edu

### VANDERBILT INVENTORS:

Wellington Pham, Ph.D.,  
John C. Gore, Ph.D.,  
Radiology and Radiological Sciences, Vanderbilt  
University Institute of Imaging Science (VUIIS)

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