InnovaBalt - Dual modality fluorescence and computed tomography system for *in vivo* imaging of neuro-inflammation

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**Background:** When fluorescent probes are used for small animal *in vivo* optical imaging, the best results are achieved when near-infrared (NIR) fluorescence emitting fluorophores are applied. NIR agents with emission wavelengths between 700-900 nm are optimal for *in vivo* applications due to their low tissue auto-fluorescence and good tissue penetration. To find the exact fluorophore location in the animal, computed tomography (CT) is used as an anatomical reference and images from two systems are combined into one that could result in sub-optimal results due to differences in animal positioning in each of the imagers. By combining X-ray and fluorescence emission tomography into one system it is possible to acquire multimodal images and analyze data with minimized risk of reposition errors. InSyTe FLECT/CT true 360° tomography system (Trifoil Imaging) is the first imager that combines CT with 360° fluorescence emission tomography (FLECT) that captures light signals all around animal. In the present study, we applied Trifoil Imaging system to assess its potential use in animal models of neuro-inflammation.

**Methods:** Nude SKH1 male mice (25-28 g) were monitored for up to 2 days after injections of the fluorescent probe. Inflammation-activatable *ProSense 750EX* probe was used to detect the progression of neuro-inflammation in the brain after intracerebroventricular (i.c.v.) and intracisternal (i.c.) administration of lipopolysaccharide (LPS). For excitation of probe, a 705 nm laser and corresponding filter (803 nm (wide)) were used. CT image of the skull was acquired with X-ray tube set to 30 kV, 950 µA, using silver filter, and with detector set to 250 ms acquisition time for each of the 360 projections. FLECT images were reconstructed using maximum available 116 source points for each slice of 1 mm thickness, while CT images were reconstructed using voxel size of 50×50×50 µm. Image analysis was performed using VivoQuant software.

**Results:** Reconstructed images were suitable for further data analysis. Using *ProSense 750EX* probe, the LPS i.c. and i.c.v. administration-induced brain inflammation was detected and precise 3D-location and time-dependent changes in size of inflamed area were determined.

**Conclusions:** Using a true 360° fluorescence emission tomography/computed tomography system and appropriate fluorescent probe allows accurate imaging of the progression of neuro-inflammation *in vivo*. 