

What Life Scientists Should Know About Molecular Imaging

Optical Imaging, Ultrasound, Photoacoustics

Application of Optical Projection Tomography to observe in-vivo and ex-vivo specimens

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Learning Objectives:

- Principle of Optical Projection Tomography (OPT)
- Application of OPT on in-vivo study
- Application of OPT on ex-vivo study
- Our work on OPT

Optical Projection Tomography (OPT) is a 3-Dimensional imaging tool for samples with size between 1 mm and 10 mm. OPT can be divided into two types: transmission-OPT and emission-OPT, which are similar to CT and FMT respectively. OPT is originally developed to observe ex-vivo samples such as embryos, organs, and tissues. Currently OPT is also applied to view in-vivo specimens such as *C. elegans*, *Drosophila*, zebrafish, and plants. Besides, helical OPT is proposed by our group to image elongated samples such as mouse colon, spinal cord, and bone. In this study we introduce the principle of OPT and its applications on in-vivo and ex-vivo samples. The detailed setup of OPT system, procedure of OPT scan, and OPT reconstruction are presented. In addition, a comprehensive introduction of OPT's application on in-vivo and ex-vivo specimens will be given. Furthermore, we show our work on OPT artifact correction and helical OPT. Experimental results show that our artifact correction methods can improve the image quality. Meanwhile, our helical OPT can image specimens about 5 cm long. Finally, we present our preliminary merging results of OPT/CT.

Relevant Publications:

1. Alicia Arranz, Di Dong, Shouping Zhu, Markus Rudin, Christos Tsatsanis, Jie Tian, and Jorge Ripoll, Helical optical projection tomography. *Optics Express*, 21(22): 25912-25925, 2013.
2. Di Dong, Shouping Zhu, Chenghu Qin, Jie Tian, and Jorge Ripoll, Automated Recovery of the Center of Rotation in Optical Projection Tomography in the Presence of Scattering. *IEEE Journal of Biomedical and Health Informatics*, 17(1):198-204, 2013.
3. Shouping Zhu, Di Dong, Udo Jochen Birk, Matthias Rieckher, Nektarios Tavernarakis, Xiaochao Qu, Jimin Liang, Jie Tian, and Jorge Ripoll, Automated Motion Correction for in-vivo Optical Projection Tomography. *IEEE Transactions on Medical Imaging*, 31(7):1358-1371, 2012.

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