Structured illumination microscopy imaging of mitochondria in living cells

Xiaoshuai Huang[1], Junchao Fan[2], Liuju Li[1], Shan Tan[2], Liangyi Chen[1]

[1]Institute of Molecular Medicine, Peking University, Beijing China

[2]School of Automation, Huazhong University of Science and Technology

E-mail: lychen@pku.edu.cn and shantan@mail.hust.edu.cn

KEY WORDS: Structured illumination microscopy, Fast, Long-term.

1. Introduction

The mitochondrion is an essential organelle to produce energy in cells. It is challenging for fluorescence microscopy due to the highly folded inner membrane with topologically complicated structures[1]. Structured illumination microscopy[2] (SIM) with our proposed reconstruction method[3] is the most suitable fluorescence microscopy to visualize mitochondrial inner membrane dynamics in living cells owing to a less photodamage and a higher resolution.

2. Results

The Hessian-SIM can retain the details and suppress the artifacts in the reconstruction. Fig.1 shows the mitochondrial inner membrane in living COS-7 cells labeled with MitoTracker Green FM under wide field (a) and 2D-SIM (b). It provides a detailed view on the inner membrane architecture in mitochondria.

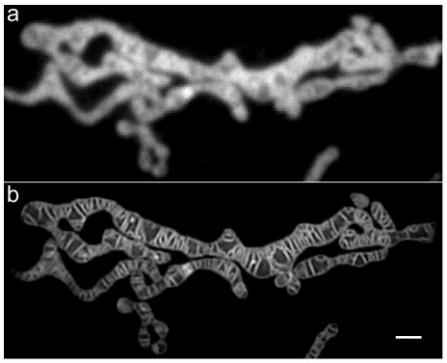

Figure 1: (a) the mitochondrial inner membrane in living COS-7 cells labeled with MitoTracker Green FM under wide field mode. (b) the corresponding Hessian reconstruction 2D-SIM result. Scale bar: 1μm.

3. Conclusion

We proposed a modified parameter estimation method and Hessian-SIM microscopy, which can visualize vivid dynamics of mitochondrial cristae structures during fusion, fission and inter-cristae remodeling in living cells.

References:

[1] Jakobs, Stefan, and Christian A. Wurm. "Super-resolution microscopy of mitochondria." Current opinion in chemical biology 20 (2014): 9-15.

[2] Gustafsson, Mats GL. "Surpassing the lateral resolution limit by a factor of two using structured illumination microscopy." Journal of microscopy 198.2 (2000): 82-87.

[3] Huang, X., et al. "Fast, long-term, super-resolution imaging with Hessian structured illumination microscopy." Nature Biotechnology 36.5(2018):451.