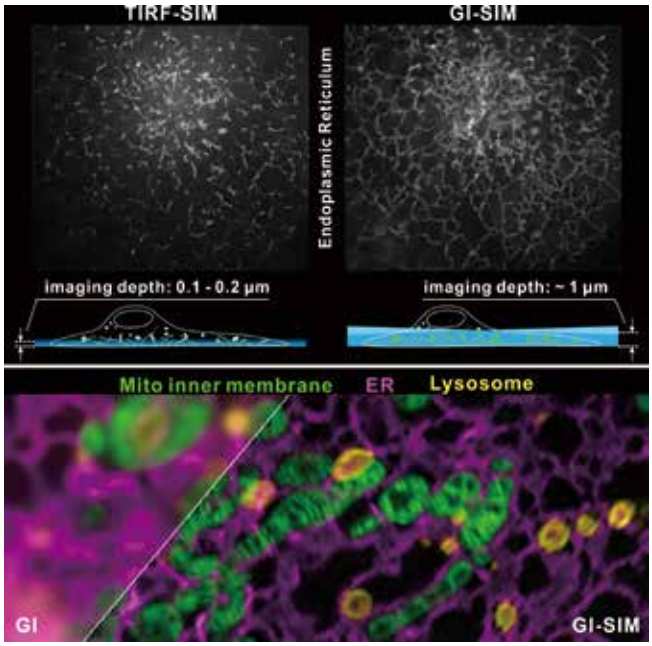
Witness Intracellular Events with a New Imaging Tool

Reported by YAN Fusheng

Seeing is the most direct way for us to recognize and understand our macroscopic world. This also applies when it comes to gaining insights into the microscopic world inside a cell. However, under a currently available microscopy, the intracellular world still seems too blurry.

To have a better look at what's going on inside a cell, scientists need better imaging tools that allow a noninvasive, real-time capture of dynamics inside a cell at a higher spatiotemporal resolution and a lower noise background. In this regard, a new kind of microscopy, termed grazing incidence structured illumination microscopy (GI-SIM), has been developed by a joint research team, led by Prof. LI Dong from the **CAS Institute of Biophysics (IBP)** in Beijing and Profs. Jennifer Lippincott-Schwartz and Eric Betzig from the Howard Hughes Medical Institute in USA. This GI-SIM enables the researchers to see more clearly inside a cell and gain new insights into many interesting intracellular events occurring among different organelles and cytoskeletons.

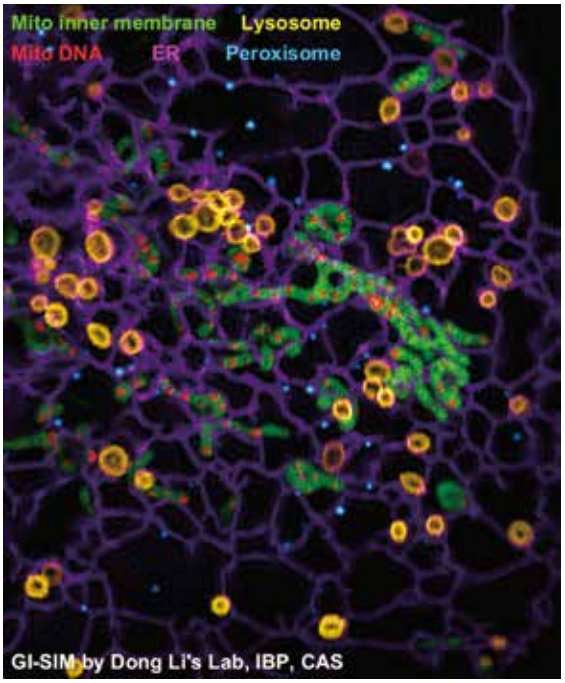
GI-SIM offers a combination of super-resolution, high-speed, multi-color imaging, low photobleaching (light-induced fading of a fluorophore) and low phototoxicity (light-induced irritation or damage). These combined features make it well suited for studying intracellular dynamics. The use of GI-SIM allows the scientists to directly observe the dynamic instability of microtubules (a type of cytoskeleton) and tubular endoplasmic reticulum (a type of interconnected membrane network within cytoplasm), and to gain new insights into their mechanisms. This new imaging tool will also expand our understanding of organelle-organelle hitchhiking: this



GI-SIM, a new approach of microscopy, enables an in-depth and clearer vision of intracellular organelles.

scenario is now found to be mediated by membrane contact sites, which tether the hitchhiker to the vehicle organelles. Moreover, endoplasmic reticulum-mitochondria contact sites are found to promote both mitochondrial fission and fusion, with aid of this novel imaging tool.

In short, visualizing intracellular dynamic events in real time with super-resolution opens a new window on the understanding of underlying mechanisms for biological processes. "The advent of this new imaging tool may bring cell biology into a new era," commented WANG Xiaofan, a Foreign Member of CAS and a professor at Duke University School of Medicine, who is not involved in this study.



Multiple intracellular components and their dynamic interactions can be clearly visualized in an almost real-time manner with the aid of multi-color GI-SIM. (Credit: IBP)

Reference

Yuting Guo, Di Li, Siwei Zhang, Yanrui Yang, Jia-Jia Liu, Xinyu Wang, Chong Liu, Daniel E. Milkie, Regan P. Moore, U. Serdar Tulu, Daniel P. Kiehart, Junjie Hu, **Jennifer Lippincott-Schwartz*, Eric Betzig*, Dong Li***, Visualizing Intracellular Organelle and Cytoskeletal Interactions at Nanoscale Resolution on Millisecond Timescales. *Cell* 175, 1430 (Published: October 25, 2018). doi: 10.1016/j.cell.2018.09.057.