PROCORE - FRANCE/HONG KONG JOINT RESEARCH SCHEME COMPLETION REPORT

Project Reference Number

F-HK010/12T

Project Title

Highly Efficient Multiphoton Absorbing Fluorophores for Biological and Biomedical Applications

Particulars

	Hong Kong team	French team
Name of Project Co-ordinator (with title)	English: Prof. Ricky M. S. Wong Chinese: 黃文成教授	Prof. Frédéric Bolze
Name of Co-Investigator (if any)	English: Chinese:	
Institution or Institutional affiliation	[ ] CityU [ ] HKU [ ] CUHK [ ] HKUST [√] HKBU [ ] LU [ ] HKIEd [ ] PolyU	[ ] CEA [ ] INRA [ ] CNRS No. [ ] INRIA [ ] INFREMER [ ] INSERM No. [√] University of Strasbourg [ ] Others:
Other project team members (if any)		

Funding Period

	1st year	2nd year (if applicable)
Start Date	1 Jan 2013	1 Jan 2014
Completion Date	31 Dec 2013	31 Dec 2014

Objective(s) as per original application

1. To design, synthesize and characterize novel series of multiphoton absorption fluorophores for large multiphoton absorption cross-sections;
2. To investigate the optical and multiphoton absorption properties of the newly synthesized fluorophores and establish the structure-property relationships;
3. To investigate the multiphoton excited fluorescence imaging and sensing in biological system using the newly developed fluorophores;
4. To compare the ways of dealing with multidisciplinary research and teaching in Hong Kong and in France; and
5. To initiate broader interaction between the biophotonic communities between France and Hong Kong.

[Please attach relevant document(s)]

i) Outline of proposed research and results obtained

The sub-cellular targeting properties of the indole-based cyanines was investigated and tuned by the substituent attached onto the indole moiety.
Their applications for two-photon excited fluorescence imaging and sensing in biological system was also studied.

ii) Significance of research results

We have demonstrated that the sub-cellular targeting properties of the indole-based cyanines can be tuned by the substituent attached onto the indole moiety in which a highly nuclear rRNA selective turn-on fluorophore has been developed. Our results also reveal that the indole-based cyanine fluorophores exhibit excellent biocompatibility in terms of low cytotoxic effect, high cell permeability to live cells and superior photostability, which are essential to be used as fluorescent trackers in live cells. Importantly, one of these cyanines, namely MPI was found to bind more than 3-fold stronger to RNA than DNA in buffer solution and to selectively stain/target RNA in nuclei of live cells. In addition, MPI is highly two-photon absorption active with σ_{max} of 980 GM at 930 nm in DMSO. Remarkably, the TPEF brightness ($\Phi\sigma_{max}$) is dramatically increased in the presence of rRNA giving rise to the record high $\Phi\sigma_{max}$ of 228 GM and thus affording high contrast and brightness TPEF images of rRNA in nucleolus of live cells. Furthermore, this RNA-selective probe shows excellent counterstaining compatibility with commercially available DNA or protein trackers in nuclei. Our findings have demonstrated that MPI is a highly effective RNA-selective TPEF light-up probe for distinct nucleolus imaging in live cells.

iii) Research output

A joint publication has recently accepted for publication.

(1) L. Guo, M. S. Chan, D. Xu, D. Y. Tam, F. Bolze, P. K. Lo, M. S. Wong Indole-based Cyanine as a Nuclear RNA-Selective Two-Photon Fluorescent Probe for Live Cell Imaging *ACS Chem. Bio.* DOI 10.1021/cb500927r.

iv) Potential for or impact on further research collaboration

Our research collaboration on the development of two-photon molecular probes will continue. We are also planning to submit a joint proposal for funding application.