Department of Chemistry
香港城市大學
City University of Hong Kong

Department of Biomedical Engineering
香港城市大學
City University of Hong Kong

Joint Departmental Seminar

By

Prof. Frederic Bolze

Équipe Nanoparticules intelligentes
Laboratoire de Chémo-Biologie Synthétique et
Thérapeutique, UMR 7199 Université de Strasbourg/CNRS,

From two-photon microscopy to photoacoustic imaging

Date: **24 October 2024 (Thursday)**

Time: **10:30 am – 11:45 am**

Venue: **LI-2413 (2nd Floor)**
Li Dak Sum Yip Yio Chin Academic Building
City University of Hong Kong
Tat Chee Avenue, Kowloon Tong

For abstract, please refer to the attached sheet.

Contact: Prof. LO Pik Kwan Peggy (3442-7840, peggylo@cityu.edu.hk)
Prof. TIN Chung (3442-5145, chungtin@cityu.edu.hk)

~ All Are Welcome ~

Abstract

Fluorescence microscopy is nowadays of crucial role in most biological research fields. One of its development, two-photon excited fluorescence microscopy, allows now long term and deep imaging from cells cultures to small animal and organoids.[1] Fluorophores used in classical fluorescence microscopy are not automatically efficient with two-photon excitation. Thus, an important field of research is the development of new dyes (small organic molecule but also proteins) for two-photon excited microscopy.[2] Hence, we are developing new two-photon sensitive dyes for many years.[3] During these studies, some chromophores were discarded due to low fluorescence quantum yields, even those showing efficient two-photon excitation. Exploring in details the Perrin-Jablonsky diagram, we can point out other detection methods which could be used for imaging of other deexcitation pathways than the classical radiative ones.

After an introduction on the Perrin-Jablonsky diagram with an imaging point of view, we will expose the principles of molecular engineering of two-photon excitable chromophores and discuss the parameters making them usable or not in fluorescence microscopy. For non- or low- fluorescent ones, we will show that they can efficiently be used in another imaging technique lying on a different physical principle for detection of the signal.[4] Indeed, after excitation, another deexcitation pathway relying on heat dissipation (non-radiative processes) can occurs. If a modulated or pulsed excitation light is used, not only heat but also an acoustic wave can be emitted. This wave, in the ultrasound range, can be detected with a resolution in the same range as the fluorescent microscopy one leading to "microscopic" images in depth.[5]

References

*[1] Helmchen F., Denk W, Nat. Meth. (2005), **2**, 932.*

*[2] Pawlicki M. et al Angew. Chem. Int. Ed. (2009), **48**, 3244.*

*[3] Hayek A. et al, Angew. Chem. Int. Ed. (2006), 45, 6466; Hayek A. et al, Bioconj. Chem. (2007), **18**, 844; Fenga X. J. et al, Org. Lett. (2010), **12**, 2194; Lux J. et al. ChemBioChem (2012), **13**, 1206; Guo L. et al ACS Chem. Biol. (2015), **10**, 1171; Yang J. et al ChemPlusChem (2018), 83, 838; Wang X. et al. ACS Appl. Mater. Interfaces (2021), **13,** 18525; Auvray M. et al. Chem.–Eur. J. (2022), **28,** e202104378; Auvray M. et al. Chem. Sci. (2023), **14**, 8119.*

*[4] Jin Y. et al Dyes Pigm. (2024), **222**, 111866.*

*[5] Wei L. et al, Biomed. Eng. Lett. (2018), **8**, 203; Luu P et al, Commun Biol (2024), **7**,364.*

Biography

Frederic Bolze got a Ph. D. From University of Burgundy (Dir. R. Guilard) and from University of Sherbrooke (Dir. P.D. Havey) on chemistry and photophysics of bis-porphyrin and bis-corrodes systems. He the moved to the University of Texas at Austin for a post-doctoral fellowship in J.L. Sessler lab to work on extended prophyrinic systems. He was then recruited in 2002 as assistant professor in J.F. Nicoud team to develop two-photon sensitive dyes for biological imaging. He is now associate professor in A. Specht lab at the faculty of pharmacy of the University of Strasbourg on the same thematic. Frederic Teaches mainly organic chemistry and develops new teaching approaches on the use of microcontroller and multidisciplinary approaches for undergraduates at the faculty of Chemistry.