Jeudi 11 Septembre 2025 à 10h30 // Thursday 11th September @ 10h30

Amphi GREGORY

Ecole Polytechnique @ IPParis

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Plasmonic nanowire-based intracellular delivery

The introduction of biomolecules such as proteins and DNA into cells is a powerful strategy for controlling cellular functions, with broad applications from fundamental biology to medical applications. Conventional delivery methods—such as liposomes, viral vectors, and electroporation—are widely used but sometimes suffer from low efficiency or cytotoxicity in certain cell types. Microinjection,[1] which directly inserts micro- or nanoneedles into cells, can achieve reliable delivery but remains limited in versatility due to limitations on the kinds of molecules it can carry.

To overcome these challenges, we have developed a new delivery platform based on plasmonic nanowire single live-cell endoscopy.[2] By integrating plasmonic nanowires with functional molecules, we can achieve precise intracellular delivery of diverse biomolecules into a single live cell. For example, by integrating photo-responsive nitric oxide gas release metal-organic frameworks (NOF-1) with a plasmonic nanowire, we have successfully demonstrated intracellular gas delivery.[3] Furthermore, we have recently developed novel photocleavable molecules for intracellular protein delivery, providing a valuable chemical biology tool.[4] In this seminar, I will present these advances, including the application of this newly developed molecular tool.

1) A. Shakoor, W. Gao, L. Zhao, Z. Jiang, D. Sun , *Microsystems & Nanoengineering*, **2022**, *8*, 47.
2) G. Lu, H. De Keersmaecker, L. Su, B. Kenens, S. Rocha, E. Fron, C. Chen, P. Van Dorpe, H. Mizuno, J. Hofkens, J. A. Hutchison, H. Uji-i, *Adv. Mater*., **2014**, *26*, 5124
3) T. Inose, J. Lopez-Cabrelles, J. Troyano, S. Tokuda, E. Sánchez-González, N. Takahashi, Y. Mori, K.Hirai, H. Uji-i, S. Furukawa, *ChemRxiv*., **2025**, DOI: 10.26434/chemrxiv-2025-n2q0c
4) M. Yoshimura, R. Sasayama, T. Kajiwara, C. Mori, Y. Nakasone, T. Inose, *Angew. Chem. Int. Ed*., **2025**, e202502376.; M. Yoshimura, T. Inose, *ChemRxiv*., **2025**, DOI: 10.26434/chemrxiv-2025-kv7qp