MOLECULAR SCIENCES
biochemie
chemie
pharmazie

Master thesis

GOETHE UNIVERSITÄT
FRANKFURT AM MAIN

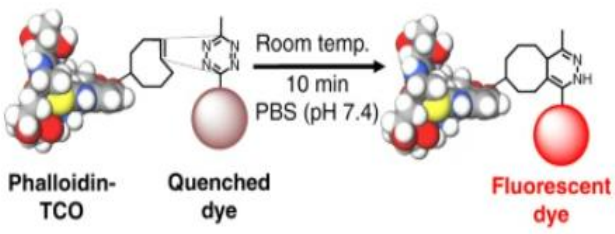
Introducing click-chemistry to DNA-PAINT/STED-PAINT

Motivation

DNA based points accumulation for imaging in nanoscale topography (DNA-PAINT) is a technique that has revolutionised the world of super-resolution microscopy by making use of nucleotide hybridisation and fast binding-unbinding kinetics to acheive transient binding without compromising much on the flurophore used or buffer used[1]. DNA-PAINT has also been shown to be useful for quantitative analysis of biomolecules in fixed cells[2]. On the other hand, genetic code expansion (GCE) as a technique has also made rounds due to its specificity in targetting biomolecules using click chemistry (nobel prize 2022 in chemistry) in live and fixed cells and also due to its ability to get the flurophore right in proximity to the biomolecule of interest relative to other available techniques which introduce a certain distance between the fluorophore and target[3]. Combining these two techniques could prove as an advantage in the future for biological questions where live cell quantitative imaging is required to understand structural cell biology.

Task Description

You would be tasked with establishing the DNA-PAINT in cohort with click chemistry based on genetic code expansion. Briefly, you would have to express certain proteins in cells through different transfection methods and optimize these conditions. Next, you would be using different super-resolution imaging techniques, optimize imaging conditions as a proof of principle and apply expertise on quantitative techniques available in our lab. You would ideally bring in motivation to work on such a project, interest in handling cell culture and love to handle different microscopes. Experience in cell culture/transfection would be a plus.



An example click reaction based on GCE[3]

Key References

1. Jungmann, R. *et al.* Single-molecule kinetics and super-resolution microscopy by fluorescence imaging of transient binding on DNA origami. *Nano Lett.* **10**, 4756–4761 (2010).
2. Jungmann, R. *et al.* Quantitative super-resolution imaging with qPAINT. *Nat. Methods 2016 135* **13**, 439–442 (2016).
3. Beliu, G. *et al.* Bioorthogonal labeling with tetrazine-dyes for super-resolution microscopy. *Commun. Biol.* **2**, (2019).

Work Area

Laboratory	■ ■ ■ □ □
Microscopy	■ ■ ■ □ □
Data Analysis	■ ■ □ □ □
Programming	□ □ □ □ □

Time

Possible Start

Fall 2023

Duration

Minimum of 6 months

Contact

Ashwin Balakrishnan/Laurell Kessler

Language English