# FRET Nanoarrays in DNA Origami Platforms and their Application as Ratiometric Sensor

Ilko Bald[1,2], Youngeun Choi[1,2], Lisa Kotthoff[2], Lydia Olejko[1], Ute Resch-Genger[2]

[1] *Institute of Chemistry-Physical Chemistry, University of Potsdam, Germany*
[2] *Federal Institute for Materials Research and Testing (BAM), Berlin, Germany*
*Email: bald@uni-potsdam.de*

DNA origami nanostructures [1] are excellent platforms to arrange dye molecules with nanoscale accuracy. This allows for assembly of multiple fluorophores whilst avoiding dye-dye aggregation. With the aim of developing a bright and sensitive ratiometric sensor, the optical properties of nanoarrays built on DNA origami nanostructures were systematically studied. Here, dye molecules were arranged at distances where they can interact efficiently *via* Förster resonance energy transfer (FRET). First, the brightness as well as FRET efficiencies of nanoarrays of different sizes and patterns were studied using fluorescein (FAM) and cyanine 3 (Cy3) as the FRET donor and acceptor, respectively. Utilizing the nanoarray giving the optimum FRET efficiency and brightness, a ratiometric pH nanosensor was subsequently designed where coumarin 343 was used as the analyte unresponsive FRET donor and FAM as the pH responsive acceptor. Our results showed that the sensitivity of a ratiometric sensor could be improved by simply arranging the dyes into a well-defined array [2]. The fabrication process used here allows for easy replacement of the dyes with other analyte-responsive dyes, demonstrating the huge potential of our design for further sensing applications.

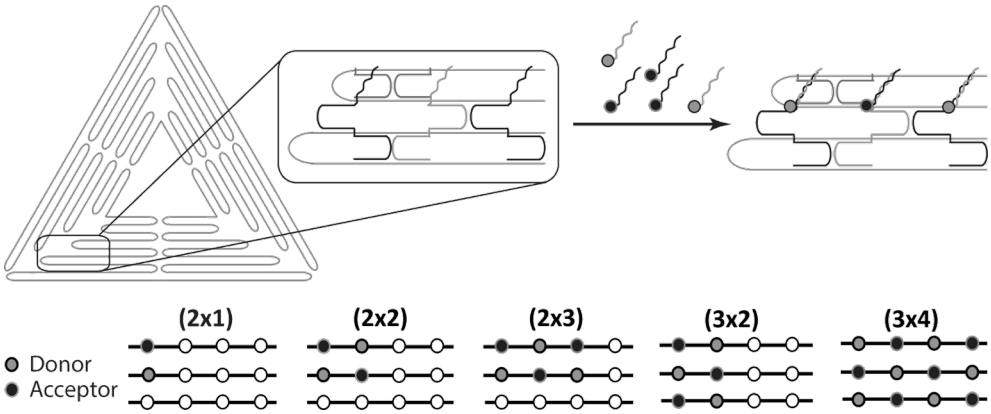


**Figure 1:** Illustration of the DNA origami nanostructure based Förster resonance energy-transfer (FRET) nanoarrays. Upper panel shows the fabrication process allowing for the arrangement of the dyes in a well-defined array, as well as providing high versatility. Bottom panel illustrates the different nanoarrays built for optimization of FRET efficiency as well as brightness.

## References

[1] P. Rothemund, Nature 2006, **440**, 297.
[2] Y. Choi, L. Kotthoff, L. Olejko, U. Resch-Genger, I. Bald, ACS Appl. Mater. Interfaces 2018, **10**, 23295.