Self-Blinking Nanographene with Cationic Side Chains for Super-Resolution Bioimaging of Live-Cell Membrane

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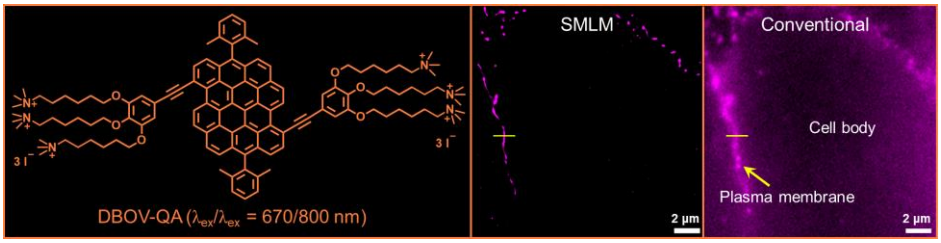
Single-molecule localization microscopy (SMLM) is a powerful technique to achieve super-resolution imaging beyond the diffraction limit. SMLM protocols usually include small-molecule dyes (*e.g.*, cyanine, rhodamine, and oxazine). Unfortunately, these typically require blinking buffers with external additives, such as glutathione, ascorbic acid, and oxygen-scavenging agent, to realize effective blinking. Such buffers are incompatible with live cells, restricting their applicability in life science.[1] Nanographenes have emerged as self-blinking fluorophores for SMLM imaging. Dibenzo[*hi*,*st*]ovalene (DBOV), a highly stable and red emissive nanographene, has enabled blinking buffer-free SMLM imaging of amyloid fibrils, live-cell lysosomal dynamics, and neural nascent proteins via click chemistry, demonstrating great promise for highly versatile SMLM.[2] Nevertheless, nanographenes with intrinsic subcellular targeting properties have remained unexplored.

We report the synthesis of a water-soluble DBOV derivative bearing cationic side chains with quaternary ammonium terminals (DBOV-QA). DBOV-QA exhibited the longest-wavelength absorption peak at 670 nm and a broad near-infrared emission with a maximum at 800 nm in water. Single-molecule fluorescence studies revealed the self-blinking characteristics. Moreover, cellular distribution analysis demonstrated its high affinity to plasma membrane structures, allowing for the super-resolution SMLM bioimaging of live-cell membranes. We thus achieved a membrane-targeting nanographene with self-blinking properties, paving the way to visualizing and tracking nanoscale membrane structures and dynamics by super-resolution microscopy.



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