DOCTORAL THESIS

Molecular recognition of [pi]-conjugated fluorophores for supramolecular nanostructures and bio-sensing applications

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Molecular Recognition of π-Conjugated Fluorophores for Supramolecular Nanostructures and Bio-sensing Applications

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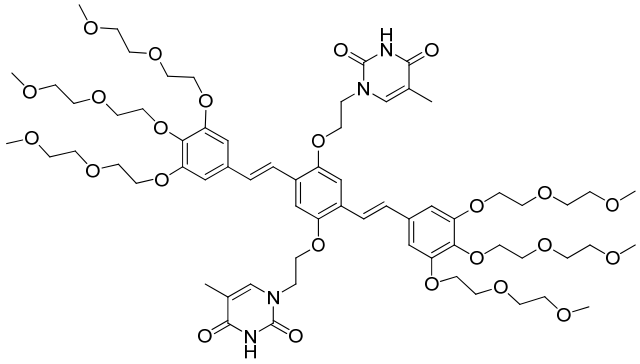
Abstract

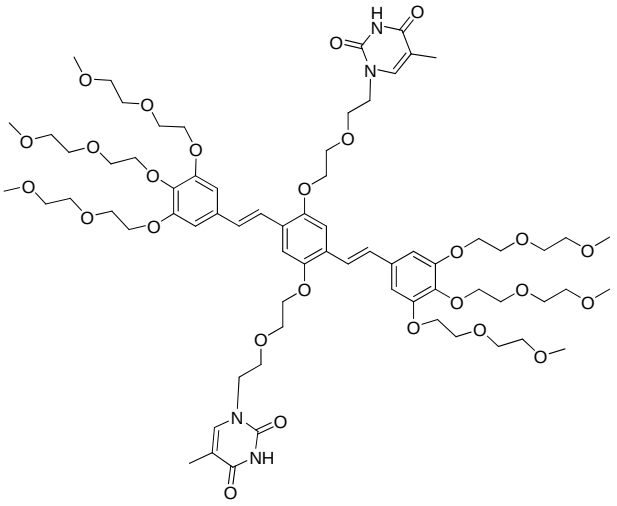
Several series of novel well-defined π-conjugated chromophores including asymmetrical and unsymmetrical end-capped distyrylbenzene derivatives, namely **DSB-EOT**, **DSB-POT** and **DSB-DAT**; Carbazole-based cyanine fluorophores, namely **SPOH**, **SLM**, **SLOH**, **SLE**, **SLG**, **Me-SLOH**, **Me-SLM**, **Me-SLG**, **SLOH-Pr**, **SLCOOH**, **SLAce**, **SAM**, and **SAOH**, have been designed and synthesized. All these newly synthesized molecules were characterized with ^{1}H NMR, ^{13}C NMR, MS and elemental analysis or HRMS and found to be in good agreement with the desired structures.

The photophysical properties of these novel synthesized π-conjugated oligomers such as UV-vis absorption, fluorescence emission and quantum yield in different solvents were investigated. The molecular recognition properties of distyrylbenzene derivatives towards DNA were studied by ^{1}H NMR titration, MS measurement, CD spectroscopy, UV-vis absorption, and emission spectroscopies. Furthermore, the supramolecular organizations of these molecules using ssDNA as template were investigated by TEM and AFM images. On the other hand, the molecular recognition properties of the novel carbazole-based cyanine molecules were studied by the fluorescence titration with ct-DNA and $A\beta_{40}$ peptide, together by TIRFM images. Most importantly, some of these cyanine fluorophores showed inhibition effect to $A\beta_{40}$ peptide fibrillogenesis and neuroprotective effect towards the cytotoxicity induced by different forms of $A\beta_{40}$ peptide. The molecular structures of these newly synthesized π-conjugated fluorophores are shown as

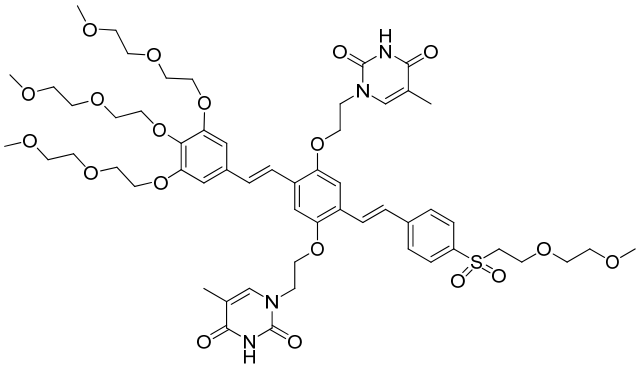
follows:



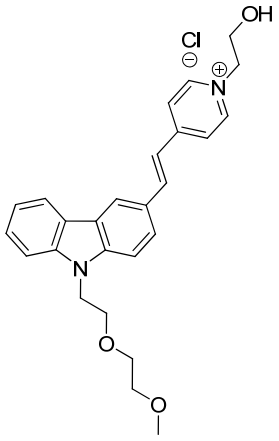
DSB-EOT



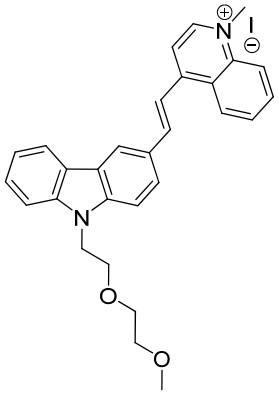
DSB-POT



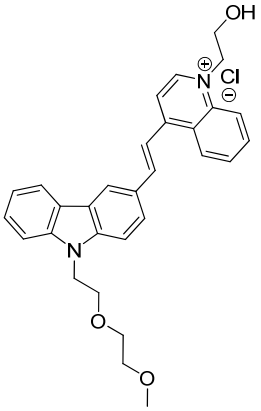
DSB-DAT



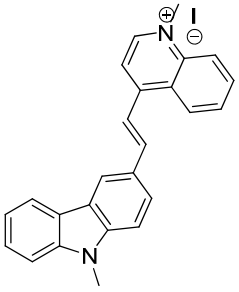
SPOH



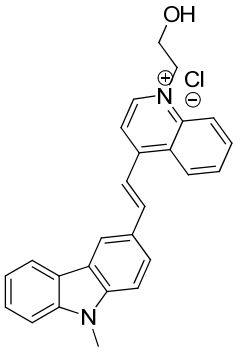
SLM



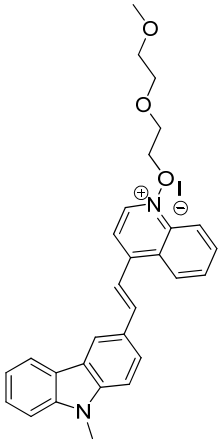
SLOH



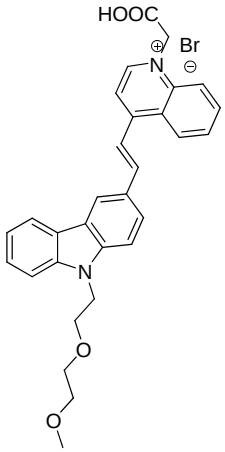
Me-SLM



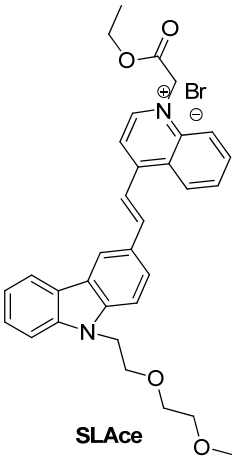
Me-SLOH



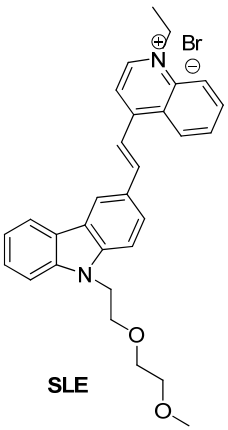
Me-SLG



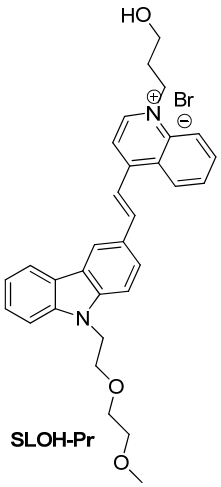
SLCOOH



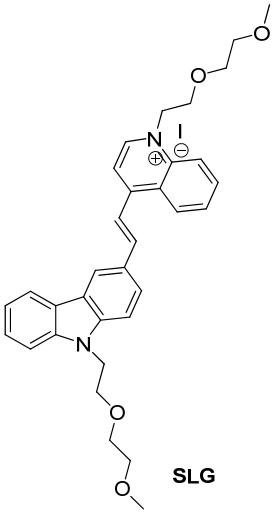
SLAce



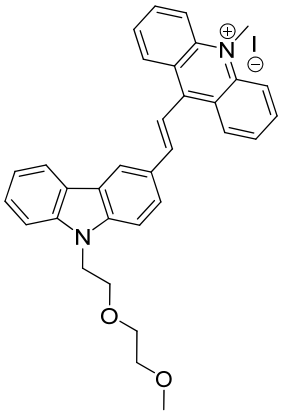
SLE



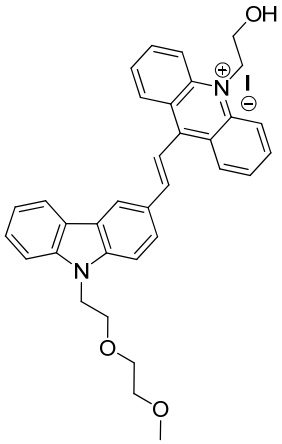
SLOH-Pr



SLG



SAM



SAOH

Table of Contents