

Nucleic acids visualization by amphiphilic naphthalenediimides emissive probes

F. Cardano,^a G. Renno,^a M. Fresia,^a M. Blangetti,^a C. Prandi,^a G. Viscardi,^a A. Fin^a

^aDepartment of Chemistry, University of Turin, Via P. Giuria 7, 10125, Turin, Italy.
francesca.cardano@unito.it

Naphthalenediimides (NDIs) are highly versatile fluorophores deeply explored throughout the last century.¹ The first synthetic report on substituted NDIs dates to 1937 while useful synthetic strategies to modulate their intrinsic structure and photophysical properties have been recently reported.^{2,3} NDIs have been investigated for a *plethora* of diversified applications spanning from supramolecular chemistry, catalysis through anion- π interactions, organic electronics up to chemical biology.¹ NDIs in biological chemistry have been mainly targeted to nucleic acids, lipid bilayer membranes and studied as biosensors for cell imaging.⁴⁻⁶ They have been proposed as DNA intercalators: their small size and flat profile easily allow the insertion between base pairs in DNA duplex.⁴

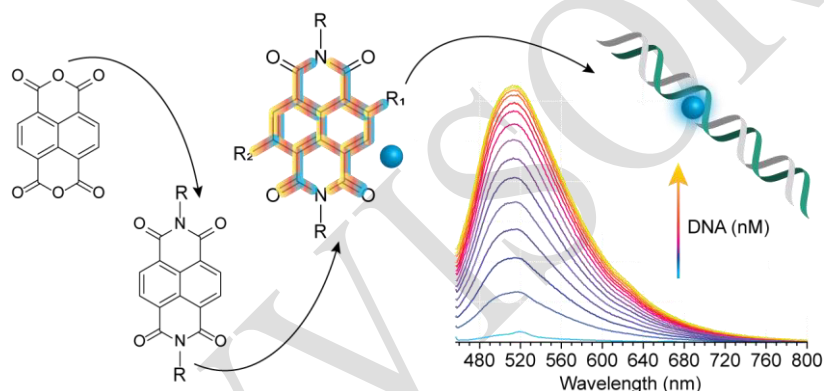


Figure 1. DNA intercalation by fluorescent NDIs.

Herein we present preliminary studies of NDIs decorated with hydrophilic appendages at the imide sides. These, to the best of our knowledge, are the first examples of emissive NDIs able to intercalate into double stranded DNA. Our results show that the amphiphilic balance on the NDI core is fundamental to prompt an efficient intercalation: highly hydrophobic/hydrophilic NDIs are indeed characterized by either negligible or invariant emission readouts in physiological buffer upon DNA titration. The NDIs ability to intercalate with a fluorescence turn-on and the DNA sequences will be analysed in relationship to their core functionalization and the amino acid nature on the imide edges to point out the best candidate for the visualization of nucleic acids in living cells.

References:

- [1] S.V. Bhosale, M. Al Kobaisi, R.W. Jadhav, P.P. Morajkar, *Chem. Soc. Rev.* 2021, 50, 9845-9998.
- [2] H. Vollmann, H. Becker, M. Corell, H.N. Streeck, H. Liebigs, *Ann. Chem.* 1937, 531, 1-159.
- [3] A. Fin, I. Petkova, D.A. Doval, N Sakai, E. Vauthey, S. Matile, *Org. Biomol. Chem.* 2011, 9, 8246-8252.
- [4] E.J. Gabbay, R. DeStefano, C.S. Baxter, *Biochem. Biophys. Res. Commun.* 1973, 51, 1083-1089.
- [5] D.A. Doval, A. Fin, M. Takahashi-Umeyayashi, H. Riezman, A. Roux, N Sakai, S. Matile, *Org. Biomol. Chem.* 2012, 10, 6087-6093.
- [6] G.S. Khan, A. Shah, Z. Rehman; D. Barker, *J. Photochem. Photobiol. B Biol.* 2012, 115, 105-118.