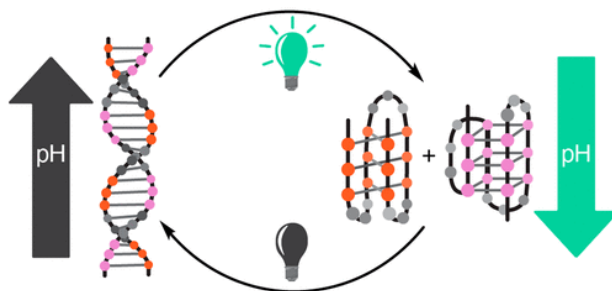


Modulating the Lifetime of DNA Motifs Using Visible Light and Small Molecules

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Who are the corresponding authors and what are their research areas?

Jonathon E. Beves

Beves completed his PhD under the joint supervision of Prof. Ed Constable and Prof. Catherine Housecroft in Basel (Switzerland). From 2009 to 2012 he was Postdoctoral Fellow at the University of Edinburgh (UK), under the supervision of Prof. David A. Leigh. In March 2013, he started his position at UNSW (Australia), where he was promoted to Associate Professor in 2020. His research is mostly based on different areas of supramolecular chemistry, focused on metal-ion directed self-assembly, and photo-controlled processes.

Felix J. Rizzuto

Rizzuto completed his PhD in supramolecular chemistry in 2018, under the supervision of Prof. Jonathan Nitschke at the University of Cambridge (UK). He then moved to Montreal (Canada) for a Postdoctoral position in Prof. Hanadi Sleiman's group. Since 2022, he moved to UNSW (Australia), where his research is focused on out-of-equilibrium nanotechnologies for DNA polymers and materials synthesis.

What is the main claim of the article?

Main claim: In this work, the authors designed a dissipative system based on DNA oligomers and a photoactive merocyanine/spiropyran photoacid. They used native (i.e. non modified) double strand DNA that is cytosine-rich and guanine-rich. These DNA oligomers spontaneously rearrange in *i*-motif and G-quadruplex at acidic pH, obtained after light irradiation of the merocyanine/spiropyran acid. If the energy supplied (light) to the system is turned off, it returns to the initial state during the time, confirming its dissipative nature. The cycling can be repeated multiple times, without any damaging consequence for the system. This approach is versatile and was applied to different DNA oligomers, tuning the initial pH, the length and sequences of DNA bases. Importantly, this strategy avoids 1) the need for *ad hoc* modified DNA strand mismatches and 2) covalent bonding of photoresponsive directly to the DNA base pairs.

How is it demonstrated?

Demonstration: The different conformations assumed after light irradiation (from double strand to *i*-motif and G quadruplex) are demonstrated by several spectroscopic techniques (UV-Visible, circular dichroism, NMR).

Conditions: UV-Vis/CD: spectra are recorded in 1 mm quartz cuvette. Sample concentrations are the following: 1.5 mM photoacid (merocyanine), 7.5 mM MgCl₂, 100 mM KCl (higher when KOH_{aq} was added), 10-20 μM oligonucleotides (Cytosine-rich and Guanine-rich sequence each) depending on the length of the sequence.

NMR: 3.0 mM photoacid, 10 mM MgCl₂, 100 mM KCl, 0.10 mM DNA oligomers at pH 6.5, ~ 50% D₂O. The NMR spectra were measured using H₂O solvent suppression and 1024 (or 2048) scans.

Light source: 470 nm quartz LED for bench spectroscopies, whereas 470 nm high-power LED collimator source together with multimode optical fiber was employed for NMR monitoring *in situ*.

Which are the key related papers?

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- Huajie Liu, Yun Xu, Fengyu Li, Yang Yang, Wenxing Wang, Yanlin Song, Dongsheng Liu, Light-Driven Conformational Switch of *i*-Motif DNA, *Angew. Chem. Int. Ed.* **2007**, 46, 14, 2515–2517 <https://doi.org/10.1002/anie.200604589>
- Laura Wimberger, Joakim Andréasson, Jonathon E. Beves, Basic-to-acidic reversible pH switching with a merocyanine photoacid, *Chem. Commun.*, **2022**, 58, 5610-5613 <https://doi.org/10.1039/D2CC00805J>