

Spiropyran as a potential molecular diagnostic tool for double-stranded RNA detection

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Long double-stranded RNAs (dsRNAs) are duplex RNAs that can induce immune response when present in mammalian cells. These RNAs are associated with viral replication, but recent evidences suggest that human cells naturally encode endogenous dsRNAs that can regulate antiviral machineries. In this study, we use photochromic organic compound spiropyran to profile and quantitate dsRNA expression. We show that the open form of spiropyran, merocyanine, can intercalate between RNA base pairs, which leads to protonation and alteration in the spectral property of the compound. By quantifying the spectral change, we can detect and quantify dsRNA expression level, both synthetic and cellular. We further demonstrate that spiropyrans can be used as a molecular diagnostic tool to profile endogenously expressed dsRNAs. Particularly, we show that spiropyrans can robustly detect elevated dsRNA levels when colorectal cancer cells are treated with 5-aza-2'-deoxycytidine, an FDA-approved DNA-demethylating agent used for chemotherapy. As dsRNAs are signature of virus, our work establishes potential application of spiropyrans as a simple spectral tool to diagnose human disease based on dsRNA expression.