

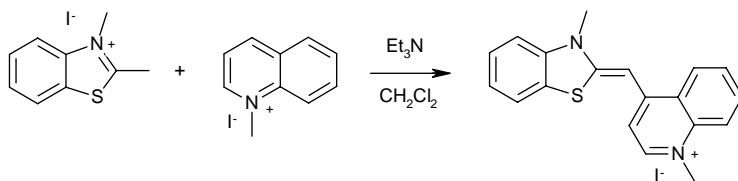
Supplementary data for

## pH-dependent fluorescence of uncharged benzothiazole-based dyes binding to DNA

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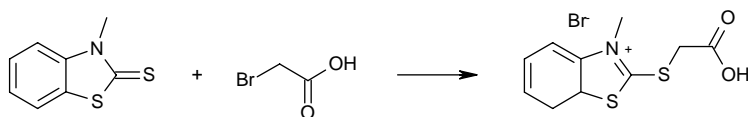
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Synthesis of 1 and 2



### 1-Methyl-4-[3-methyl-2,3-dihydro-(benzo-1,3-thiazole)-2-methylidene]quinolinium iodide

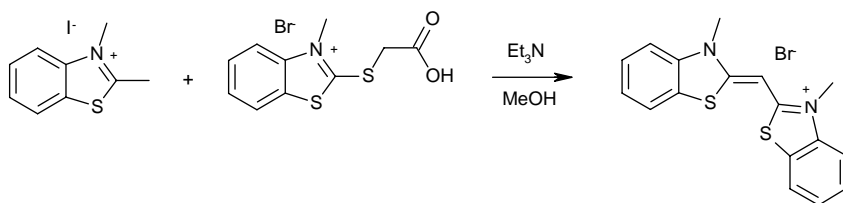
1,2-Dimethylbenzothiazolium iodide<sup>1</sup> (873 mg, 3.00 mmol) and 1-methylquinolinium iodide<sup>2</sup> (813 mg, 3.00 mmol) were suspended in dichloromethane (50 mL). Triethylamine (4.2 mL, 30 mmol) was added to the suspension, and the resultant red solution was stirred at 25 °C overnight. Diethyl ether (100 mL) was added, and then the resultant suspension was stirred for 10 min. The precipitation was filtered, washed with diethyl ether, and dried under reduced pressure. Water (50 mL) was added to the resultant red solid and the suspension was stirred for 10 min. The precipitation was filtered, washed with water, and dried under reduced pressure. 1-Methyl-4-[(3-methyl-2(3H)-benzothiazolyliidene)methyl]quinolinium iodide (536 mg, 41 %) was obtained as a red solid;  $\lambda_{\max}$  (DMSO)/nm 508 ( $\epsilon/\text{dm}^3 \text{ mol}^{-1} \text{ cm}^{-1}$  66000);  $\delta_{\text{H}}$  (400 MHz, DMSO-*d*<sub>6</sub>) 8.80 (d, *J* = 8.3 Hz, 1H), 8.61 (d, *J* = 7.3 Hz, 1H), 8.07-7.99 (m, 3H), 7.80-7.76 (m, 2H), 7.63-7.59 (m, 1H), 7.43-7.36 (m, 2H), 6.93 (s, 1H), 4.17 (s, 3H), and 4.01 (s, 3H);  $\delta_{\text{C}}$  (100 MHz, DMSO-*d*<sub>6</sub>) 159.6, 148.3, 144.9, 140.3, 137.9, 133.1, 128.0, 126.8, 125.4, 124.3, 123.9, 123.7, 122.8, 118.2, 112.8, 107.7, 87.8, 42.3, and 33.8; *m/z* (FAB) 305.1116 ([*M* + *H*]<sup>+</sup> C<sub>19</sub>H<sub>17</sub>N<sub>2</sub>S calcd. 305.1112).



### 2-(Carboxymethyl)mercapto-3-methylbenzothiazolium bromide

3-Methylbenzothiazole-2-thione (3.63 g, 20.0 mmol) and bromoacetic acid (5.56 g, 40.0 mmol) were heated at 150 °C for 3 h. The resultant solid was suspended in methanol (30 mL) and diethylether (90 mL) was added. The precipitation was filtered, washed with diethyl ether, and dried under reduced pressure. 2-(Carboxymethyl)-mercapto-3-methylbenzothiazolium bromide (5.87 g, 91 %) was obtained as a white powder;  $\delta_{\text{H}}$  (400 MHz,

DMSO-*d*<sub>6</sub>) 8.42 (d, *J* = 7.8 Hz, 1H), 8.22 (d, *J* = 8.3 Hz, 1H), 7.86-7.82 (m, 1H), 7.75-7.71 (m, 1H), 4.72 (s, 2H), and 4.17 (s, 3H);  $\delta_C$  (100 MHz, DMSO-*d*<sub>6</sub>) 178.6, 167.6, 142.1, 129.3, 128.5, 127.4, 124.1, 116.1, 38.2, and 36.9; *m/z* (FAB) 240.0153 ([M + H]<sup>+</sup> C<sub>10</sub>H<sub>10</sub>NO<sub>2</sub>S<sub>2</sub> calcd. 240.0153).



### 3-Methyl-2-[3-methyl-2,3-dihydro-(benzo-1,3-thiazole)-2-methylidene]benzothiazolium bromide

2,3-Dimethylbenzothiazolium iodide<sup>1</sup> (291 mg, 1.00 mmol) and 2-(carboxymethyl)mercapto-3-methylbenzothiazole bromide (320 mg, 1.00 mmol) were suspended in methanol (10 mL). Triethylamine (700  $\mu$ L, 5.00 mmol) was added. The resultant mixture was stirred at 25 °C for 3 h. After addition of acetone (40 mL), the reaction mixture was stirred for 10 min. The precipitation was filtered, washed with acetone and water, and dried under reduced pressure. 3-Methyl-2-[3-methyl-2,3-dihydro-(benzo-1,3-thiazole)-2-methylidene]benzothiazolium bromide (286.6 mg, 72 %) was obtained as a yellow powder;  $\lambda_{\max}$  (DMSO)/nm 428 ( $\epsilon/\text{dm}^3 \text{ mol}^{-1} \text{ cm}^{-1}$  74000);  $\delta_H$  (400 MHz, DMSO-*d*<sub>6</sub>) 8.20 (d, *J* = 7.8 Hz, 2H), 7.86 (d, *J* = 8.3 Hz, 2H), 7.66 (t, *J* = 7.6 Hz, 2H), 7.47 (t, *J* = 7.6 Hz, 2H), 6.69 (s, 1H), and 4.01 (s, 6H);  $\delta_C$  (100 MHz; DMSO-*d*<sub>6</sub>) 162.1, 140.8, 128.5, 124.9, 124.8, 123.5, 113.9, 82.9, and 34.1; *m/z* (FAB) 311.0671 ([M + H]<sup>+</sup> C<sub>17</sub>H<sub>15</sub>N<sub>2</sub>S<sub>2</sub> calcd. 311.0677).

### References

1. L. G. Lee, P. D. S. Mize, Novel fluorescent dye, *US Pat.*, 4 937 198, 1990.
2. J. R. Carreon, K. P. Mahon and S. O. Kelley, Thiazole orange-peptide conjugates: sensitivity of DNA binding to chemical structure, *Org. Lett.*, 2004, **6**, 517-519.