

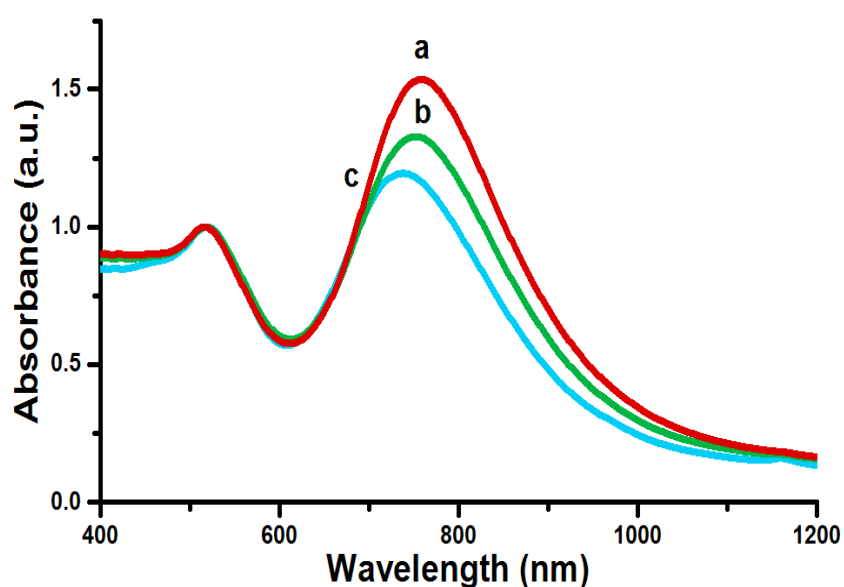
## Supporting Information

### Seedless synthesis of gold nanorods using dopamine as a reducing agent

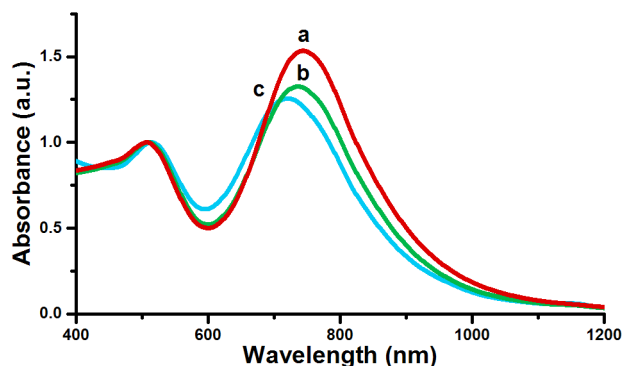
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### Synthesis of gold nanorods by seedless method with hydroquinone

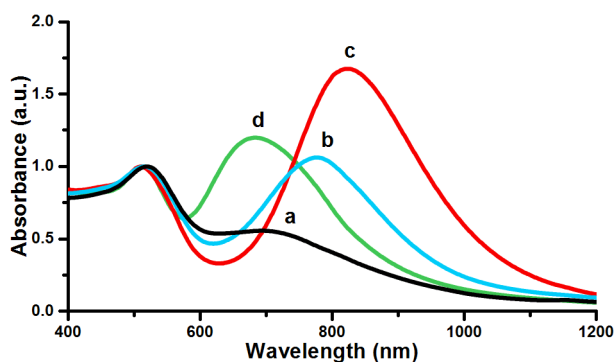
Gold nanorods were prepared by mixing CTAB (5.00 mL, 0.2 M), HAuCl<sub>4</sub> (5.00 mM, 1.0 mM), AgNO<sub>3</sub> (50 μL, 100 mM) and hydroquinone (250 μL, 100 mM). After that, the reaction was started by adding 15 μL freshly prepared 0.01 M NaBH<sub>4</sub> solution. The mixed solution was stirred for a short time and left undisturbed at 28 °C for measuring kinetics and growth of AuNRs.



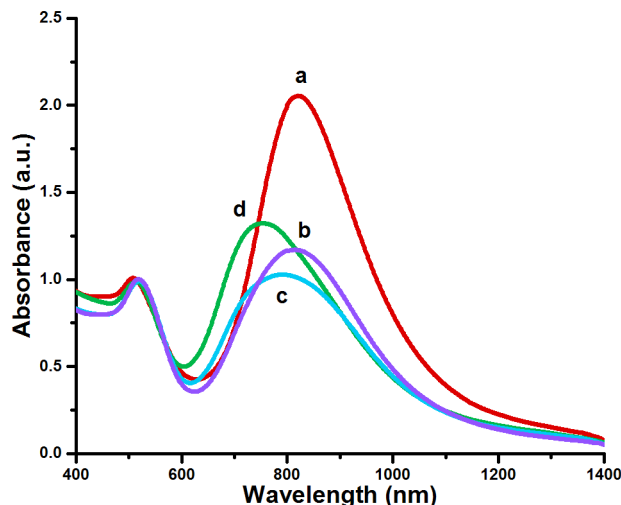
**Figure S1.** UV- Vis spectra of AuNRs synthesized by reduction with dopamine (DA) using different addition orders. a.) DA+DA; b.) H<sub>2</sub>O+DA; c.) DA+H<sub>2</sub>O. Final concentrations of preparative parameters: [CTAB] = 22 mM, [DA] = 45 mM, [HAuCl<sub>4</sub>] = 0.45 mM, [AgNO<sub>3</sub>] = 0.91 mM, and [NaBH<sub>4</sub>] = 0.018 mM. Reagent stock solutions are: [CTAB] = 5 mL/50 mM; [DA] = 0.5 mL/0.5 M (Twice), or 45 mM; [HAuCl<sub>4</sub>] = 5 mL/1 mM; [AgNO<sub>3</sub>] = 0.1 mL/100 mM, and [NaBH<sub>4</sub>] = 0.02 mL/10 mM. Total volume is 11 mL.



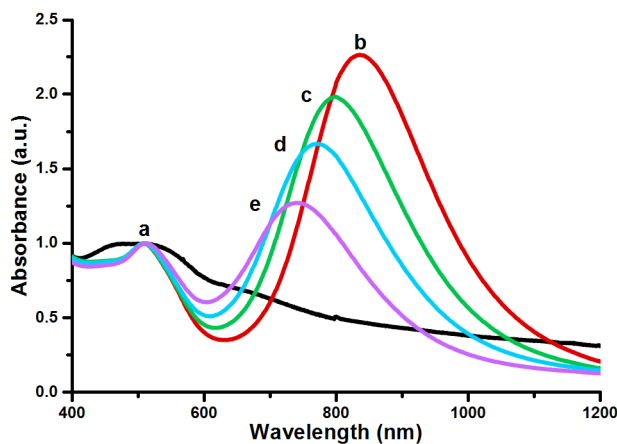
**Figure S2.** UV-Vis spectra of AuNRs synthesized at different temperatures: a) 25 °C; b) 30 °C; c) 40 °C. Final reagent concentrations: [CTAB] = 22 mM, [DA] = 27 mM, [HAuCl<sub>4</sub>] = 0.45 mM, [AgNO<sub>3</sub>] = 0.91 mM, and [NaBH<sub>4</sub>] = 0.018 mM and the total volume is 33 mL. Reagent stock solutions: [CTAB] = 15 mL/50 mM; [DA] = 1.5 mL/0.3 M, or 27 mM; [HAuCl<sub>4</sub>] = 15 mL/1 mM; [AgNO<sub>3</sub>] = 0.3 mL/100 mM, [DA] = 1.5 mL/0.3 M and [NaBH<sub>4</sub>] = 0.03/10 mM. Total volume is 33 mL.



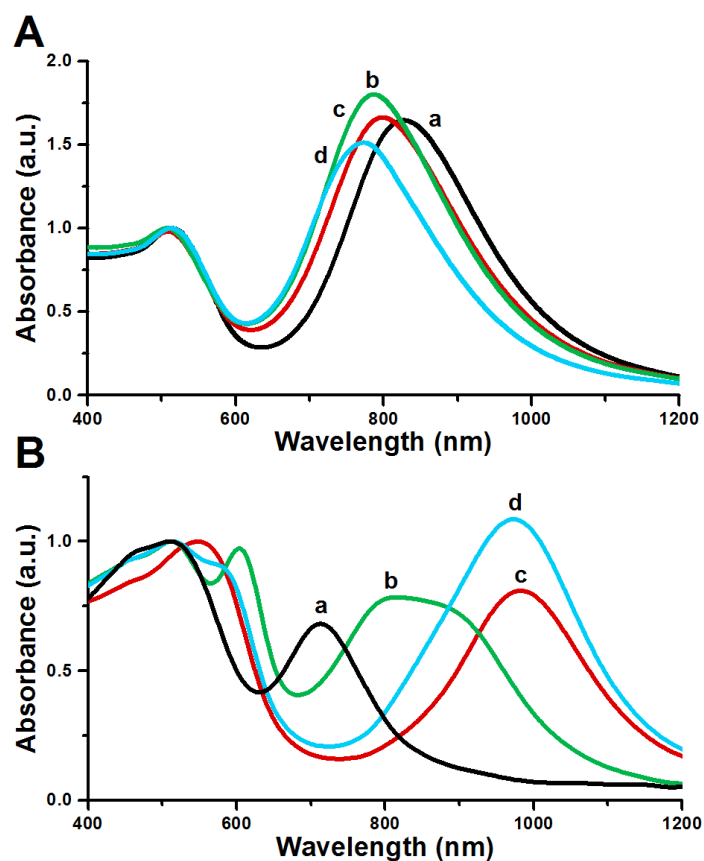
**Figure S3.** UV-vis spectra collected after 24 hours while varying the HAuCl<sub>4</sub> concentration. a) 0.112 mM b) 0.225 mM c) 0.45 mM d) 0.900 mM. All spectra are normalized at their transverse surface plasmon resonance wavelength. Final reagent concentrations: [CTAB] 22 mM, [DA] = 45 mM, [HAuCl<sub>4</sub>] = varied, [AgNO<sub>3</sub>] = 0.91 mM, and [NaBH<sub>4</sub>] = 0.018 mM. Reagent stock solutions: [CTAB] = 5 mL/0.05; [DA] = 0.5 mL/0.50 mM; [HAuCl<sub>4</sub>] 5 mL from 0.25 mM (a); 0.5 mM (b); 1 mM (c); and 2 mM (d); [AgNO<sub>3</sub>] = 0.10 mL/100 mM; [DA] = 0.5 mL/0.5 M and [NaBH<sub>4</sub>] = 0.02/10 mM. Total volume is 11 mL



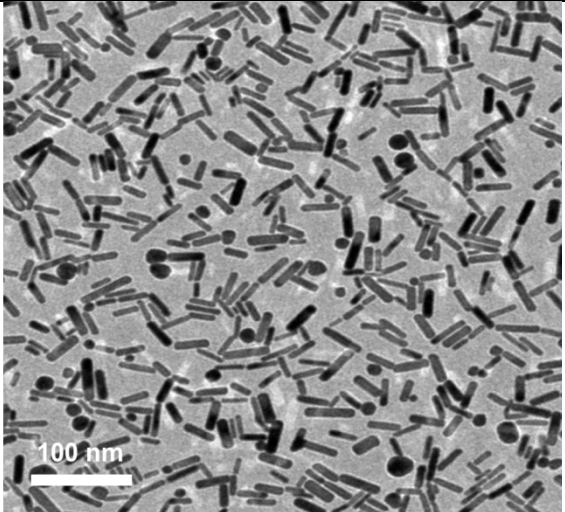
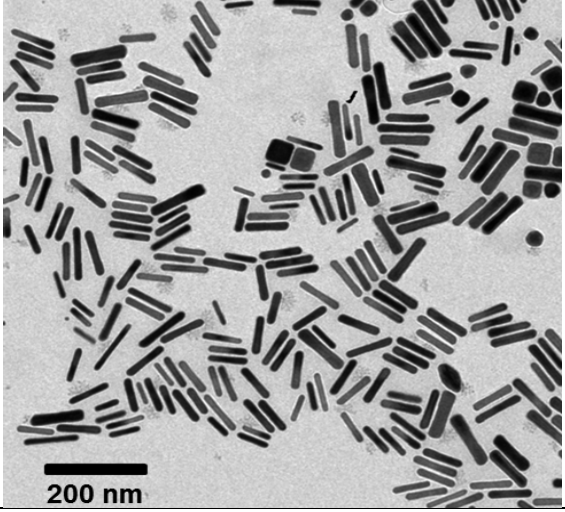
**Figure S4.** UV-vis spectra after 24 h of growth with variable concentration of HCl: a) 0  $\mu\text{M}$ , b) 1.0  $\mu\text{M}$ , c) 2.0  $\mu\text{M}$  d) 4.0  $\mu\text{M}$ . All spectra are normalized at their transverse surface plasmon resonance wavelength. Final reagent concentrations: [CTAB] 25 mM, [DA] = 45 mM, [HAuCl<sub>4</sub>] = 0.45 mM, [AgNO<sub>3</sub>] = 0.91 mM, and [NaBH<sub>4</sub>] = 0.018 mM. Reagent stock solutions: [CTAB] = 5 mL/0.05 M; [DA] = 0.5 mL/0.50 mM; [HAuCl<sub>4</sub>] 5 mL/1mM; [AgNO<sub>3</sub>] = 0.10 mL/100 mM; [DA] = 0.5 mL/0.5 M and [NaBH<sub>4</sub>] = 0.02/10 mM. HCl were added 0, 10, 20 and 40  $\mu\text{L}$  from 10 % (~1.19 M) solution.



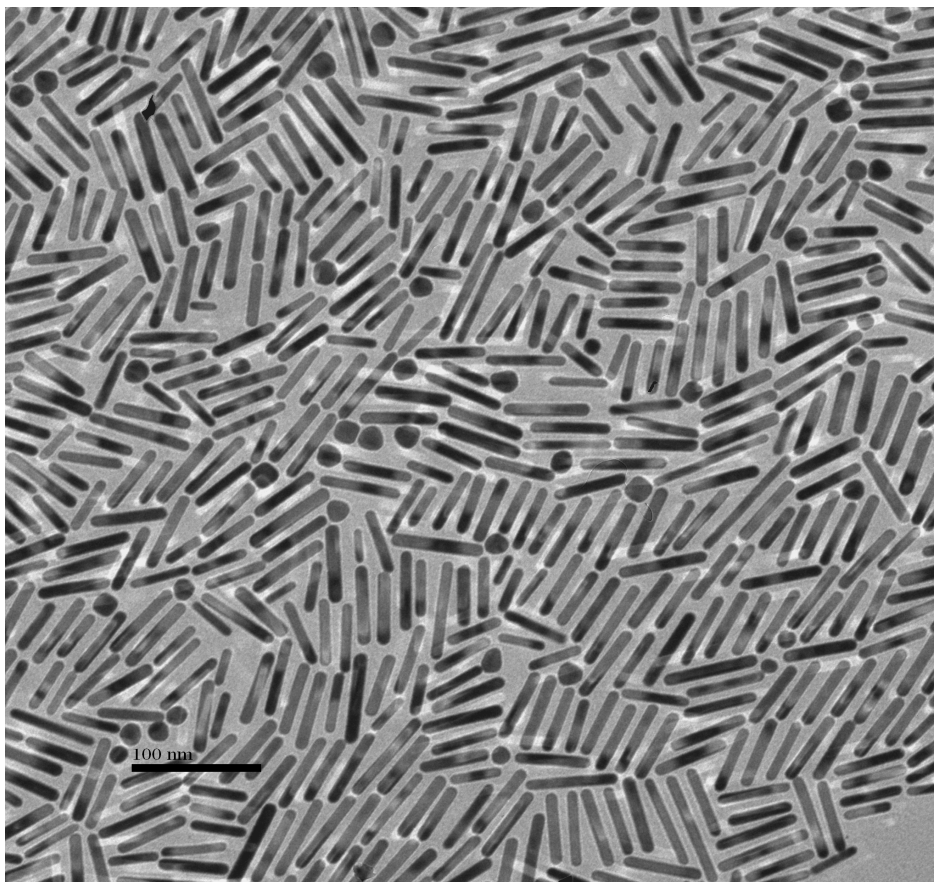
**Figure S5.** UV-Vis spectra after 4 h of AuNRs growth with different concentrations of NaBH<sub>4</sub>: a) 0  $\mu\text{M}$ , b) 4.5  $\mu\text{M}$ , c) 9.0  $\mu\text{M}$  d) 4.0  $\mu\text{M}$ . All spectra are normalized at their transverse surface plasmon resonance wavelength. Final reagent concentrations: [CTAB] 25 mM, [DA] = 45 mM, [HAuCl<sub>4</sub>] = 0.45 mM, [AgNO<sub>3</sub>] = 0.91 mM. Reagent stock solutions: [CTAB] = 5 mL/0.05 M; [DA] = 0.5 mL/0.50 mM; [HAuCl<sub>4</sub>] 5 mL/1mM; [AgNO<sub>3</sub>] = 0.10 mL/100 mM; [DA] = 0.5 mL/0.5 M and [NaBH<sub>4</sub>] were added 0, 5, 10, 15, 20 and 40  $\mu\text{L}$  from 10 mM, ice-cold solution.



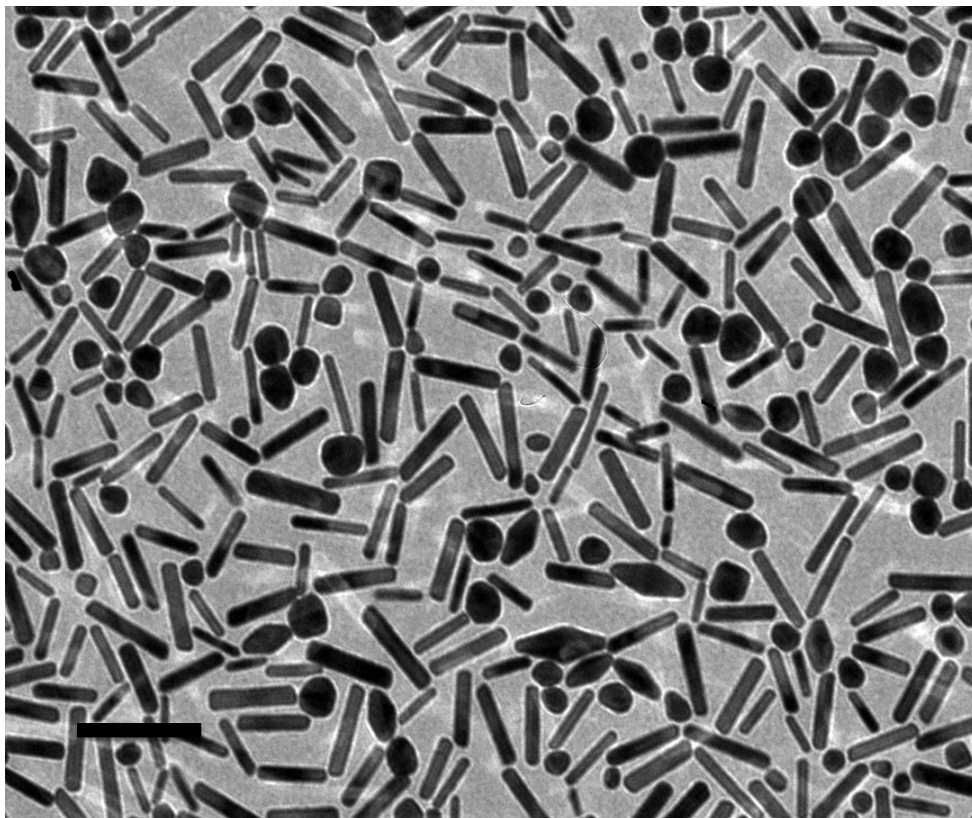
**Figure S6.** UV-Vis spectra of AuNRs prepared with different concentrations of silver nitrate:  $[\text{AgNO}_3] = 0.091, 0.182, 0.364, \text{ and } 0.909 \text{ mM}$ , or lines a,b,c,d, respectively. Final reagent concentrations:  $[\text{CTAB}] 25 \text{ mM}$  (Fig. S2A) and  $100 \text{ mM}$  (Fig. S2B),  $[\text{DA}] = 45 \text{ mM}$ ,  $[\text{HAuCl}_4] = 0.45 \text{ mM}$ , and  $[\text{NaBH}_4] = 0.018 \text{ mM}$ . Reagent stock solutions:  $[\text{CTAB}] = 5 \text{ mL}/0.05 \text{ or } 0.20 \text{ M}$ ;  $[\text{DA}] = 0.5 \text{ mL}/0.5 \text{ M}$ ;  $[\text{HAuCl}_4] = 5 \text{ mL}/1 \text{ mM}$ ;  $[\text{AgNO}_3] = \text{a) } 0.05 \text{ mL}/20 \text{ mM}$ , b)  $0.10 \text{ mL}/20 \text{ mM}$ ; c)  $0.20 \text{ mL}/20 \text{ mM}$ ; d)  $0.10 \text{ mL}/100 \text{ mM}$ ;  $[\text{DA}] = 0.5 \text{ mL}/0.50 \text{ mM}$ ;  $[\text{DA}] = 0.5 \text{ mL}/0.5 \text{ M}$  and  $[\text{NaBH}_4] = 0.02/10 \text{ mM}$ . Total volume is  $11 \text{ mL}$ .

	<p>A) Final concentrations of preparative parameters: [CTAB] = 25 mM, [DA] = 27 mM, [HAuCl<sub>4</sub>] = 0.45 mM, [AgNO<sub>3</sub>] = 0.91 mM, and [NaBH<sub>4</sub>] = 0.018 mM. Reagent stock solutions: [CTAB] = 5 mL/50 mM; [DA] = 0.5 mL/0.27 mM; [HAuCl<sub>4</sub>] = 5 mL/1 mM; [AgNO<sub>3</sub>] = 0.1 mL/100 mM, [DA] = 0.5 mL/0.27 mM; and [NaBH<sub>4</sub>] = 0.02 mL/10 mM.</p> <p>Yield 80%,</p>
	<p>B) Final concentrations of preparative parameters: [CTAB] = 25 mM, [DA] = 27 mM, [HAuCl<sub>4</sub>] = 0.45 mM, [AgNO<sub>3</sub>] = 1.82 mM, and [NaBH<sub>4</sub>] = 0.018 mM. Reagent stock solutions are: [CTAB] = 5 mL/200 mM; [DA] = 0.5 mL/0.3 M; [HAuCl<sub>4</sub>] = 5 mL/1 mM; [AgNO<sub>3</sub>] = 0.1 mL/100 mM, [DA] = 0.5 mL/0.3 M; and [NaBH<sub>4</sub>] = 0.02 mL/10 mM.</p> <p>Yield 90%,</p>
	<p>C) Final concentrations of preparative parameters: [CTAB] = 100 mM, [DA] = 45 mM, [HAuCl<sub>4</sub>] = 0.45 mM, [AgNO<sub>3</sub>] = 1.82 mM, and [NaBH<sub>4</sub>] = 0.018 mM. Reagent stock solutions: [CTAB] = 5 mL/200 mM; [DA] = 0.5 mL/0.5 M; [HAuCl<sub>4</sub>] = 5 mL/1 mM; [AgNO<sub>3</sub>] = 0.2 mL/100 mM, [DA] = 0.5 mL/0.5 M; and [NaBH<sub>4</sub>] = 0.02 mL/10 mM. Total volume is 11 mL.</p> <p>Yield 94%,</p>

**Figure S7.** TEM images of gold nanorods GNRs synthesized by reduction with dopamine in different protocol modifications. All synthesis has total volume 11 mL.



**Figure S8.** TEM image of AuNRs synthesized at medium CTAB concentration (90 mM). Other parameters: [DA] = 45 mM, [HAuCl<sub>4</sub>] = 0.45 mM, [AgNO<sub>3</sub>] = 1.82 mM, and [NaBH<sub>4</sub>] = 0.018 mM. Reagent stock solutions: [CTAB] = 5 mL/200 mM; [DA] = 0.5 mL/0.5 M; [HAuCl<sub>4</sub>] = 5 mL/1 mM; [AgNO<sub>3</sub>] = 0.2 mL/100 mM, [DA] = 0.5 mL/0.5 M; and [NaBH<sub>4</sub>] = 0.02 mL/10 mM. Total volume is 11 mL.



**Figure S9.** TEM image of AuNRs synthesized at high CTAB concentration (180 mM). Other parameters: [DA] = 45 mM, [HAuCl<sub>4</sub>] = 0.45 mM, [AgNO<sub>3</sub>] = 1.82 mM, and [NaBH<sub>4</sub>] = 0.018 mM. Reagent stock solutions: [CTAB] = 5 mL/200 mM; [DA] = 0.5 mL/0.5 M; [HAuCl<sub>4</sub>] = 5 mL/1 mM; [AgNO<sub>3</sub>] = 0.2 mL/100 mM, [DA] = 0.5 mL/0.5 M; and [NaBH<sub>4</sub>] = 0.02 mL/10 mM. Total volume is 11 mL.