Supporting Information for
Solvent-Mediated End-to-End Assembly of Gold Nanorods

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I. Stability of gold-nanorod solution in water-acetonitrile mixtures without ligands

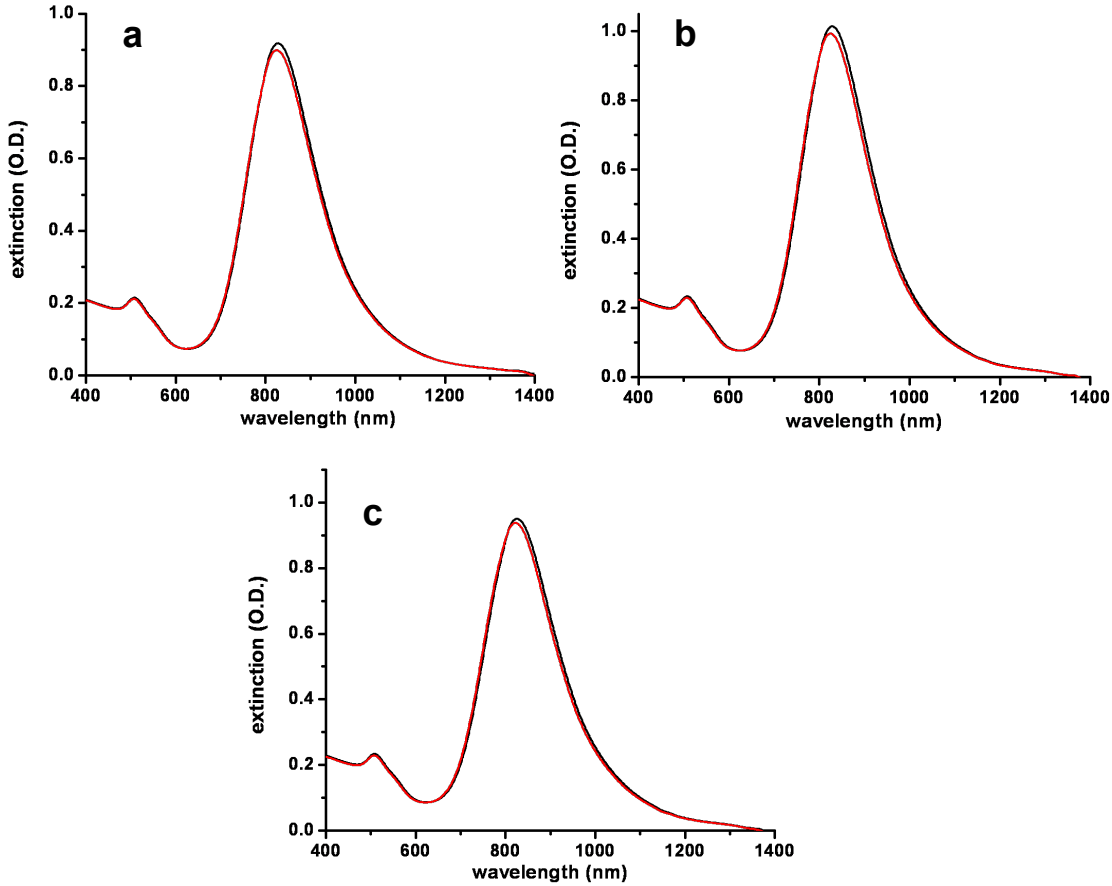

Figure S1. Extinction spectra of gold-nanorod solutions in water-acetonitrile mixtures without any added ligand molecules. Results are shown for (a) 10%, (b) 15% and (c) 20% water in acetonitrile. Black curves are measured immediately after the nanorods are transferred to the mixed solvents, and red curves are measured after five hours. The nanorod sample has been aged for 7 days.

II. Effects of sample aging on assembly

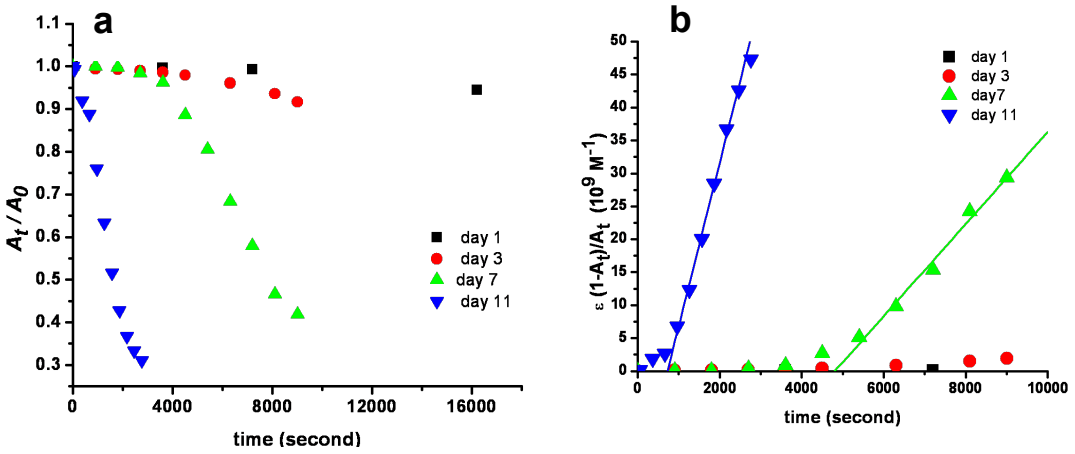

Figure S2. (a) Normalized change in extinction and (b) kinetics of gold-nanorod assembly in a solution of 10% water and 90% acetonitrile, following the addition of undecanethiol ligands such that the final ligand concentration is 5 μM. A kinetic constant $k \sim 7 \times 10^6$ M^{-1} s^{-1} is obtained for the sample that has been aged for 7 days, and $k \sim 2.5 \times 10^7$ M^{-1} s^{-1} for the sample that has been aged 11 days.

III. Effects of ligand concentration on assembly

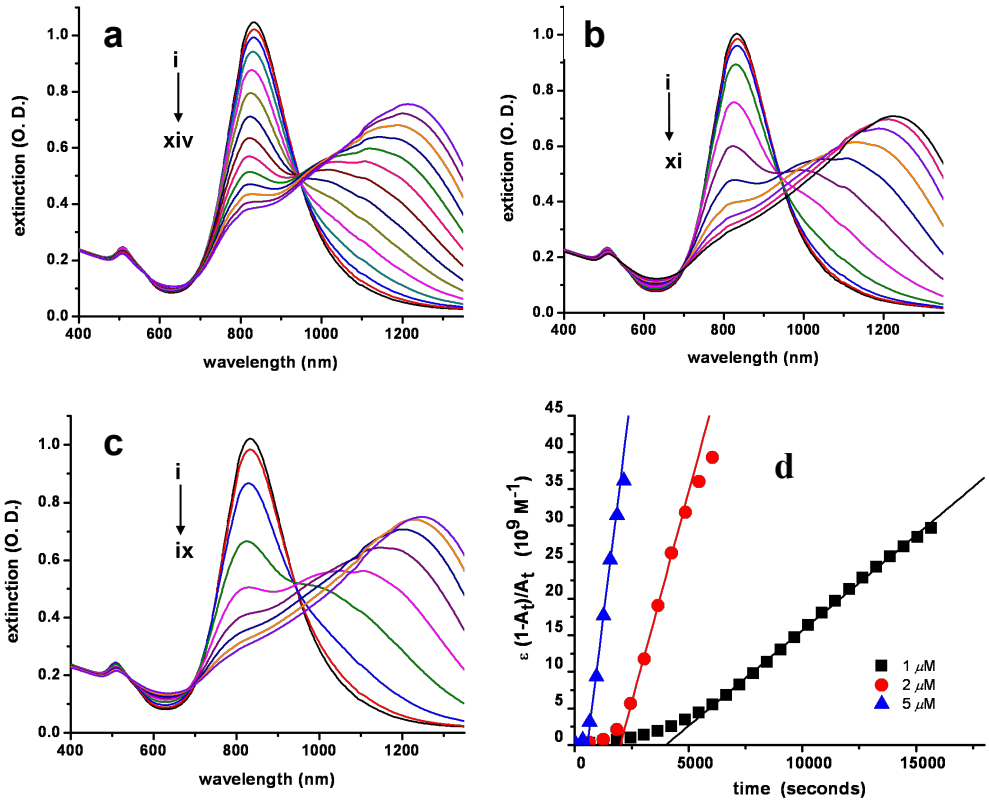

Figure S3. Measured extinction spectra of gold nanorods in a solution of 10% water and 90% acetonitrile, following the addition of undecanethiol ($C_{11}SH$). (a) 1 μM $C_{11}SH$. Curves **i – xiv** correspond to reaction times of 0 to 260 minutes, with an interval of 20 minutes. (b) 2 μM $C_{11}SH$. Curves **i – xi** correspond to reaction times of 0 to 100 minutes, with an interval of 10 minutes. (c) 5 μM $C_{11}SH$. Curves **i – ix** correspond to reaction times of 0, 1, 6, 11, 16, 21, 26, 31, and 36 minutes. (d) Kinetics of assembly obtained from the time-dependent spectra in parts (a) – (c).

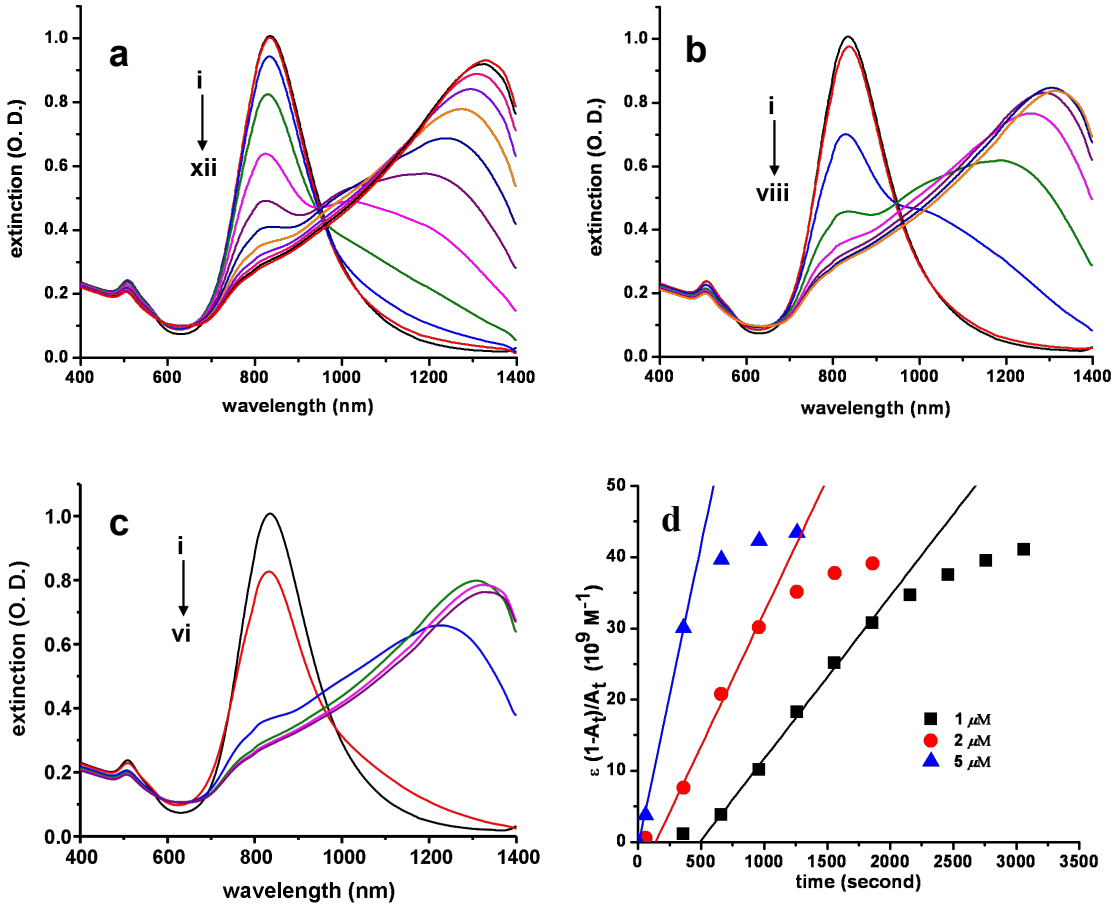

Figure S4. Measured extinction spectra of gold nanorods in a solution of 10% water and 90% acetonitrile, following the addition of *α,ω*-undecanedithiol ($C_{11}DT$). (a) 1 μM $C_{11}DT$. Curves **i – xii** correspond to reaction times of 0, 1, 6, 11, 16, 21, 26, 31, 36, 41, 46, and 51 minutes. (b) 2 μM $C_{11}DT$. Curves **i – viii** correspond to reaction times of 0, 1, 6, 11, 16, 21, 26, and 31 minutes. (c) 5 μM $C_{11}DT$. Curves **i – vi** correspond to reaction times of 0, 1, 6, 11, 16, and 21 minutes. (d) Kinetics of assembly obtained from the time-dependent spectra in parts (a) – (c).

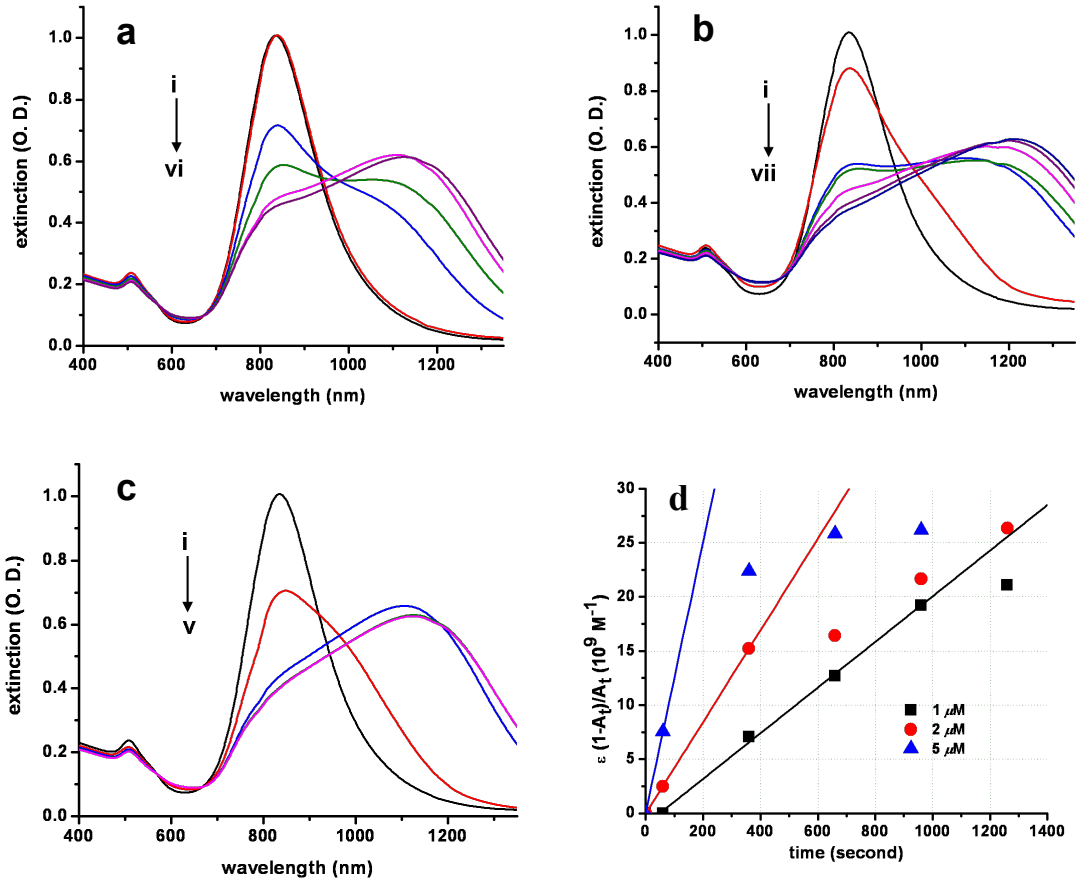

Figure S5. Measured extinction spectra of gold nanorods in a solution of 10% water and 90% acetonitrile, following the addition of 11-mercaptoundecanoic acid (MUA). (a) 1 μM MUA. Curves **i – vi** correspond to reaction times of 0, 1, 6, 11, 16, and 21 minutes. (b) 2 μM MUA. Curves **i – vii** correspond to reaction times of 0, 1, 6, 11, 16, 21, and 26 minutes. (c) 5 μM MUA. Curves **i – v** correspond to reaction times of 0, 1, 6, 11, and 16 minutes. (d) Kinetics of assembly obtained from the time-dependent spectra in parts (a) – (c).

IV. Effects of solvent composition on assembly

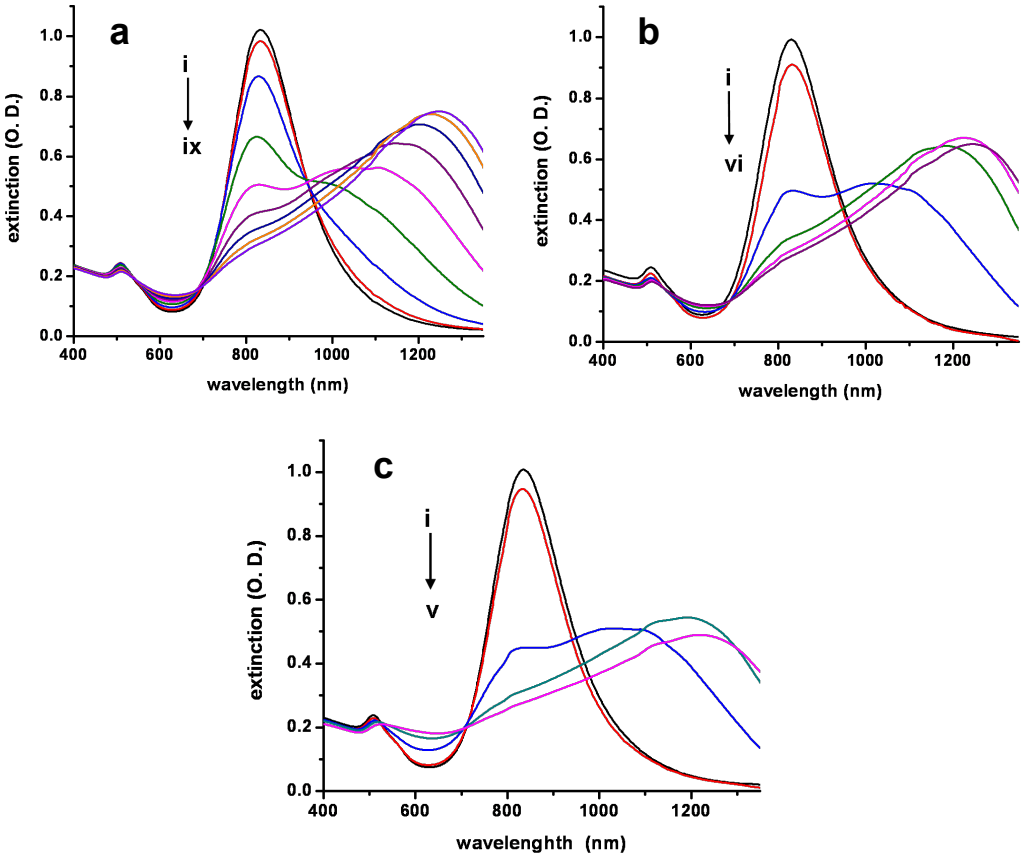

Figure S6. Measured extinction spectra of gold nanorods in a water-acetonitrile mixture, following the addition of $C_{11}SH$ such that the final ligand concentration is 5 μM. (a) 10% water / 90% acetonitrile. Curves **i – ix** correspond to reaction times of 0, 1, 6, 11, 16, 21, 26, 31, and 36 minutes. (b) 15% water / 85% acetonitrile. Curves **i – vi** correspond to reaction times of 0, 1, 6, 11, 16, and 21 minutes. (c) 20% water / 80% acetonitrile. Curves **i – v** correspond to reaction times of 0, 1, 6, 11, and 16 minutes.

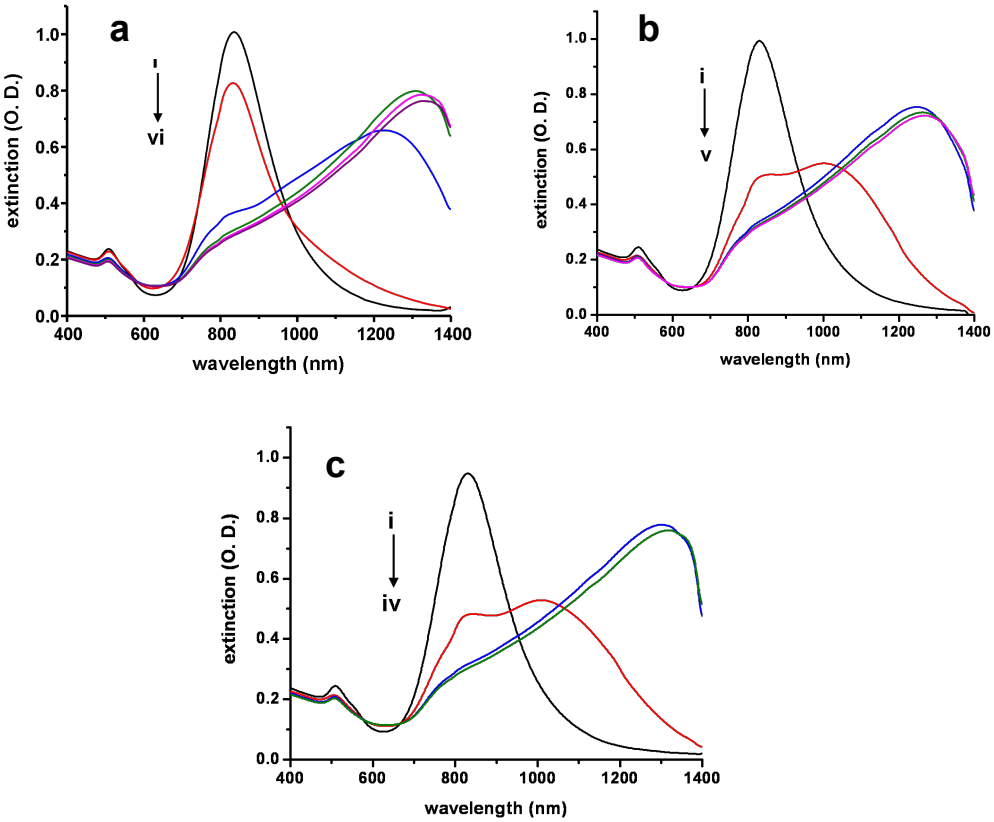

Figure S7. Measured extinction spectra of gold nanorods in a water-acetonitrile mixture, following the addition of $C_{11}DT$ such that the final ligand concentration is 5 μM. (a) 10% water / 90% acetonitrile. Curves **i – vi** correspond to reaction times of 0, 1, 6, 11, 16, and 21 minutes. (b) 15% water / 85% acetonitrile. Curves **i – v** correspond to reaction times of 0, 1, 6, 11, and 16 minutes. (c) 20% water / 80% acetonitrile. Curves **i – iv** correspond to reaction times of 0, 1, 6, and 11 minutes.

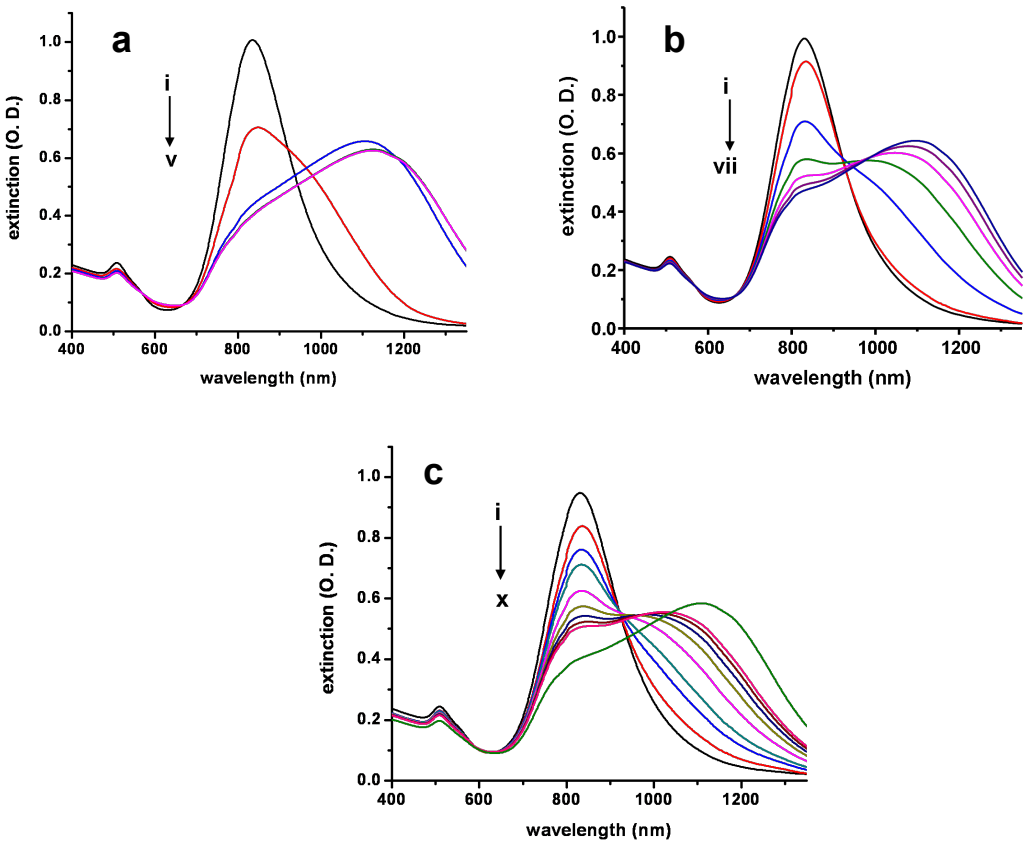

Figure S8. Measured extinction spectra of gold nanorods in a water-acetonitrile mixture, following the addition of MUA such that the final ligand concentration is 5 μM. (a) 10% water / 90% acetonitrile. Curves **i – v** correspond to reaction times of 0, 1, 6, 11, and 16 minutes. (b) 15% water / 85% acetonitrile. Curves **i – vii** correspond to reaction times of 0, 1, 6, 11, 16, 21, and 26 minutes. (c) 20% water / 80% acetonitrile. Curves **i – ix** correspond to reaction times of 0, 10, 20, 30, 60, 90, 120, 150, and 180 minutes, and curve **x** corresponds to a reaction time of 19 hours.

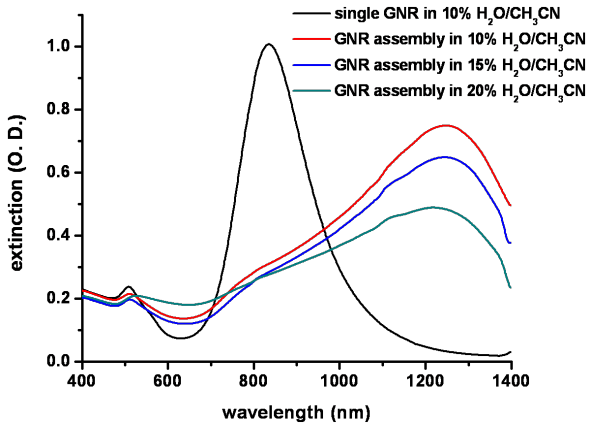

Figure S9. Measured extinction spectra of gold nanorods in water-acetonitrile mixtures, after $C_{11}SH$ has been added such that the final concentration is 5 μM, and assembly has completed (41 minutes for 10% water, 21 minutes for 15% water, and 16 minutes for 20% water).

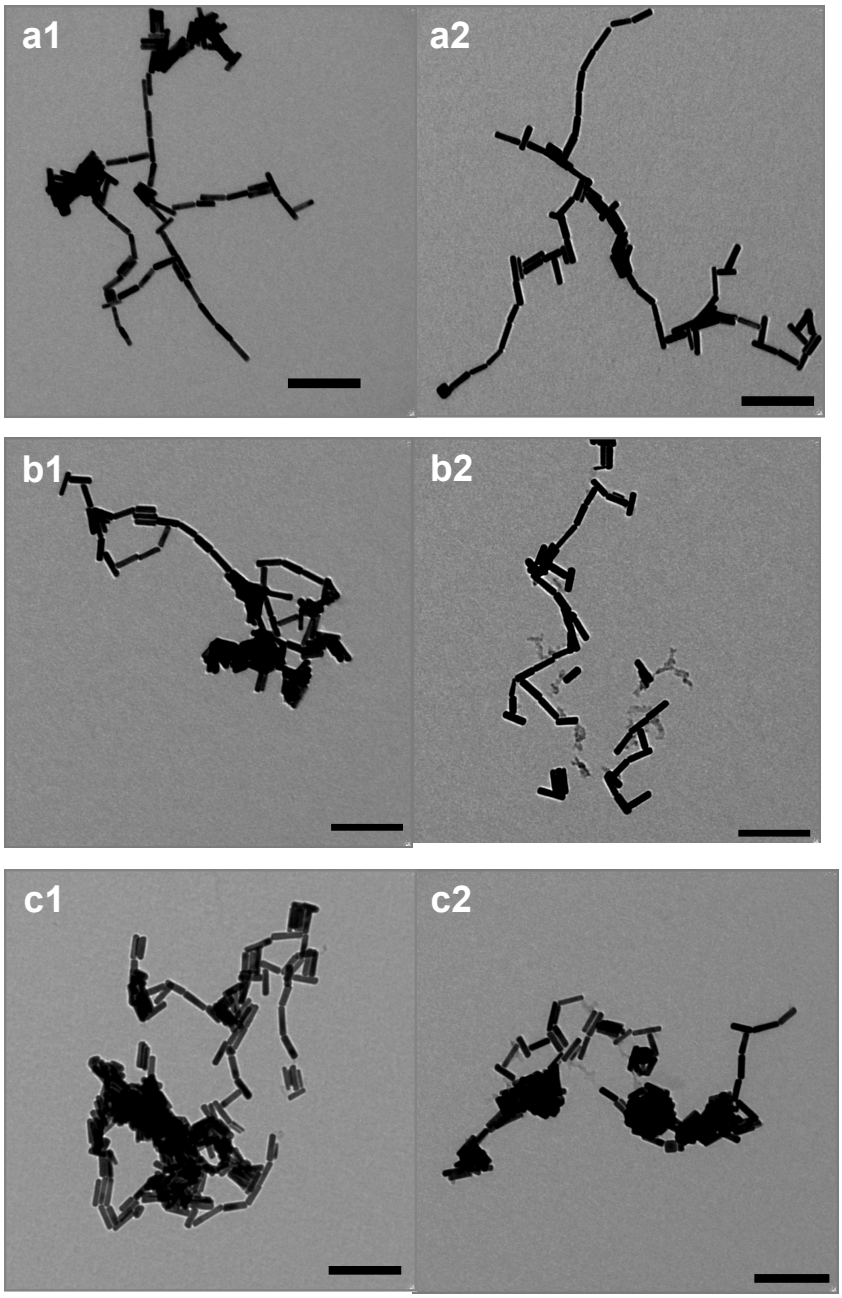

Figure S10. Transmission-electron micrographs of gold-nanorod assembly induced by the addition of $C_{11}SH$ to a solution of rods in a water-acetonitrile mixture such that the final ligand concentration is 5 μM. (a) 10% water and 90% acetonitrile, 36 minutes reaction time. (b) 15% water and 85% acetonitrile, 21 minutes reaction time. (c) 20% water and 80% acetonitrile, 16 minutes reaction time. Scale bars are 200 nm.

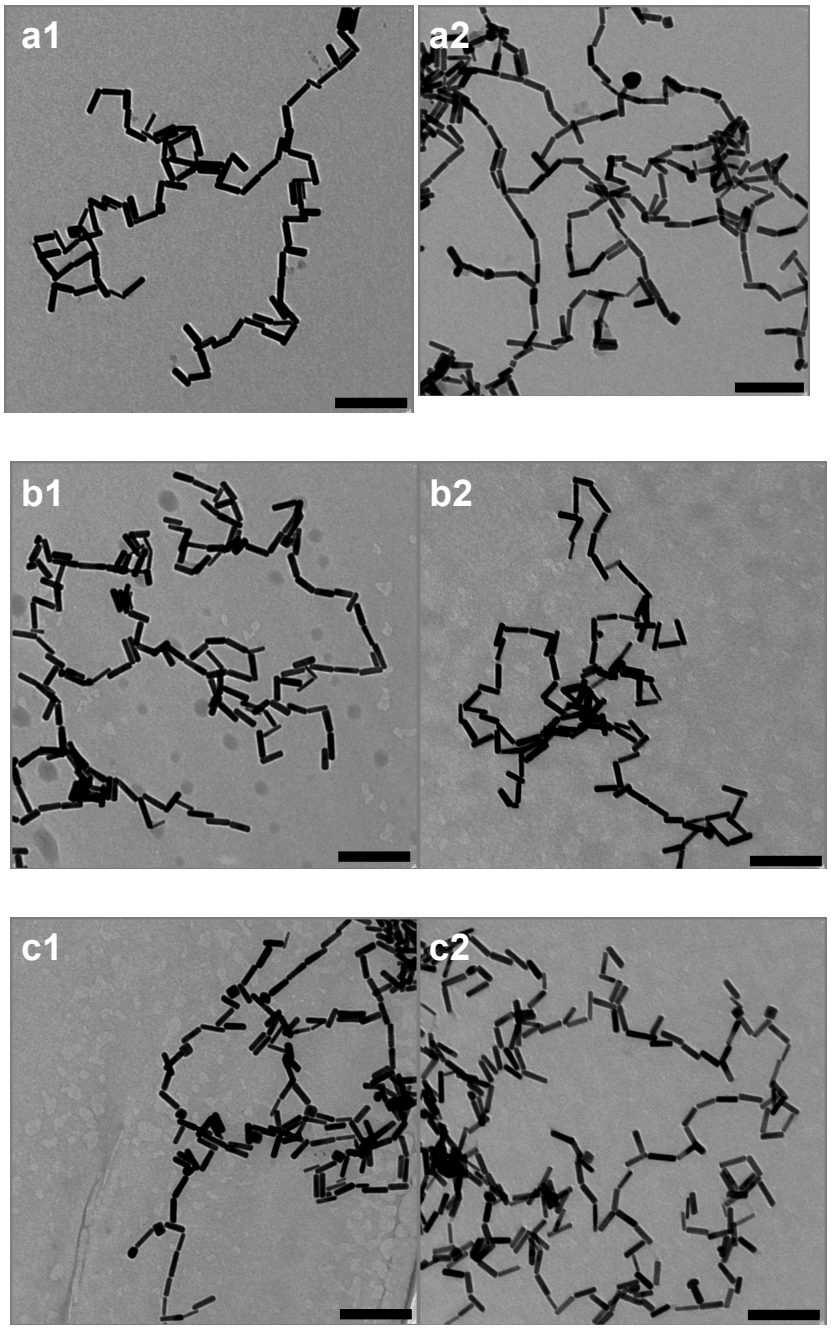

Figure S11. Transmission-electron micrographs of gold-nanorod assemblies induced by the addition of $C_{11}DT$ to a solution of rods in a water-acetonitrile mixture such that the final ligand concentration is 5 μM. (a) 10% water and 90% acetonitrile, 12 minutes reaction time. (b) 15% water and 85% acetonitrile, 21 minutes reaction time. (c) 20% water and 80% acetonitrile, 11 hours reaction time. Scale bars are 200 nm.

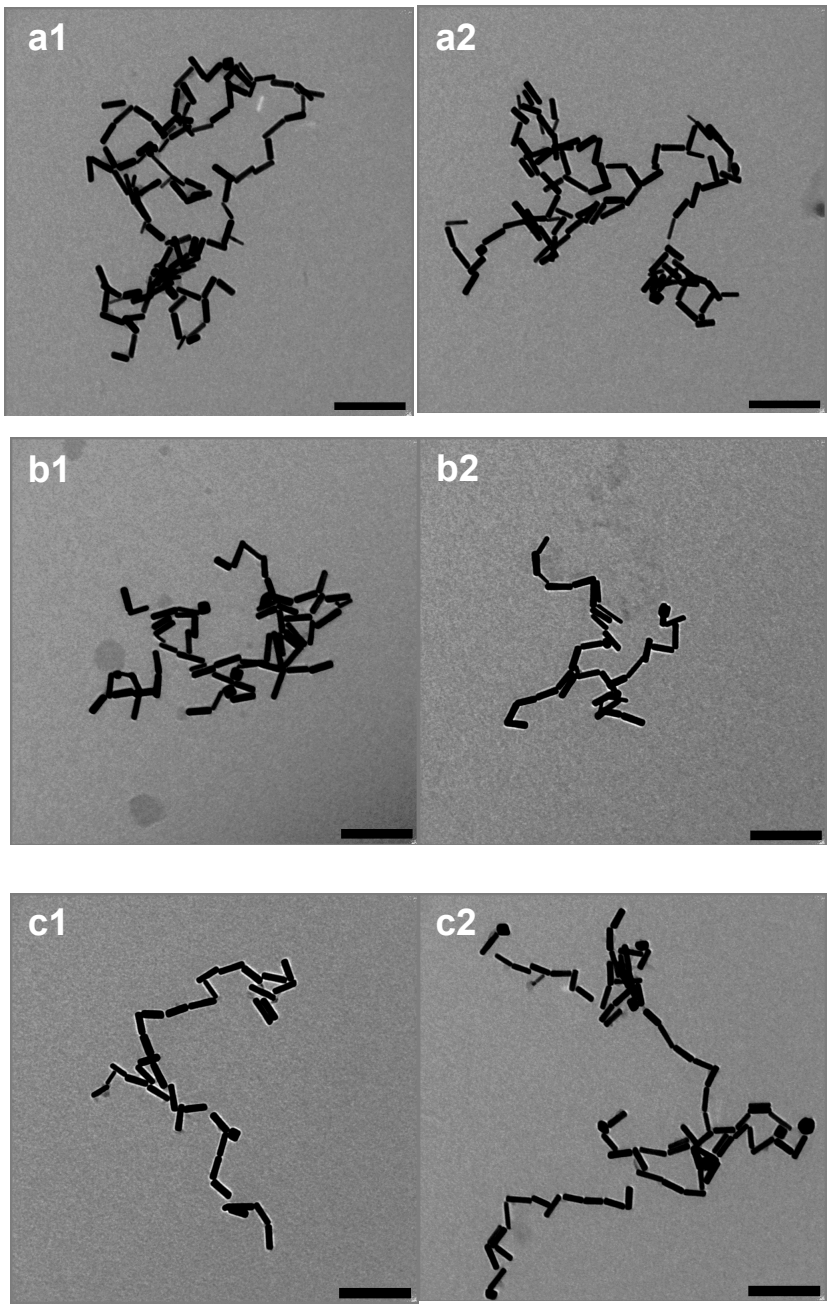

Figure S12. Transmission-electron micrographs of gold-nanorod assemblies induced by the addition of MUA to a solution of rods in a water-acetonitrile mixture such that the final ligand concentration is 5 μM. (a) 10% water and 90% acetonitrile, 16 minutes reaction time. (b) 15% water and 85% acetonitrile, 26 minutes reaction time. (c) 20% water and 80% acetonitrile, 19 hours reaction time. Scale bars are 200 nm.