

Improved Size-Tunable Synthesis of Monodisperse Gold Nanorods through the Use of Aromatic Additives

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Table S1. Typical synthetic conditions of gold NRs.^a

Additive	Amount of additive (g)	Concentration of additive in the growth solution (mol/L)	AgNO ₃ (aq) (mL)	Ascorbic acid (aq) (mL)
Sodium salicylate	0.8	0.010	6.0	1.0
Sodium 3-methylsalicylate	1.1	0.0126	6.0	1.0
3-Methylsalicylic acid	1.2	0.0158	12.0	2.0
4-Methylsalicylic acid	1.5	0.0197	12.0	2.0
2,6-Dihydroxybenzoic acid	0.6	0.0078	12.0	2.0
Salicylic acid	1.75	0.0253	12.0	2.0
Potassium bromide	3.5	0.0588	12.0	4.5
5-Bromosalicylic acid	1.1	0.0101	12.0	2.0
5-Aminosalicylic acid	1.1	0.0144	6.0	2.0
5-Chlorosalicylic acid	1.0	0.0116	12.0	2.0
3,5-Dibromosalicylic acid	0.8	0.0054	12.0	4.5

^a The amounts of CTAB and seed solution used for NR growth are 9.0 g and 0.8 mL, respectively, unless otherwise specified.

Table S2. A summary of synthetic conditions, statistical results of gold NR dimensions (length, width) and comparisons of experimental and calculated nanorod LSPR wavelengths.

Additive ^a	Seed solution (mL)	AgNO ₃ (aq) (mL)	Ascorbic acid (aq) (mL)	Dimensions ^b measured from TEM (nm)	Dimensions for FDTD calculation	Experimental LSPR peak position (nm)	LSPR peak position from FDTD calculation (nm)
Na-creso, 1.1g	0.8	6.0	1.0	33.0 ± 2.5 14.0 ± 1.0	33, 14	627	630
NaSal, 0.8g	0.8	6.0	1.0	36.0 ± 2.5 14.0 ± 1.0	36, 14	653	651
4-methylSA	0.8	12.0	2.0	51.0 ± 3.0 14.0 ± 1.5	51, 14	754	753
2,6-DA, 0.6g	0.8	12.0	2.0	51.5 ± 3.0 15.5 ± 1.5	51.5, 15.5	722	723
KBr, 3.5g	0.8	12.0	4.5	42.0 ± 4.0 12.0 ± 1.0	42, 12	734	735
5-BrSA, 1.1g	0.8	12.0	2.0	46.0 ± 3.0 12.0 ± 1.0	46, 12	757	777
5-BrSA, 1.1g	0.8	24.0	2.0	49.0 ± 4.0 10.0 ± 1.0	49, 10	904	886
5-BrSA, 1.1g	0.4	12.0	2.0	44.0 ± 3.5 10.0 ± 0.5	44, 10	824	830
5-BrSA, 1.1g	0.4	18.0	2.0	52.5 ± 3.5 12.0 ± 0.5	52.5, 12	844	828
5-BrSA, 1.1g	0.2	12.0	2.0	64.0 ± 5.0 22.0 ± 1.0	64, 22	705	723

^a The amount of CTAB used for NR growth is 9.0 g. Na-creso: Sodium 3-methylsalicylate, NaSal: Sodium salicylate, 4-methylSA: 4-Methylsalicylic acid, 2,6-DA: 2,6-Dihydroxybenzoic acid, 5-BrSA: 5-Bromosalicylic acid.

^b Dimensions are presented in the format of length (tip-tip distance measured from TEM images) and width. Statistical results are determined from TEM images. At least 150 gold NRs are counted for each set.

Table S3. pH values of different gold NR growth solutions.

Additive	pH value
None	2.76
Sodium 3-methylsalicylate	3.07
Sodium salicylate	3.03
5-Bromosalicylic acid	2.05
3-Methylsalicylic acid	2.01
4-Methylsalicylic acid	1.96
2,6-Dihydroxybenzoic acid	2.13
5-Bromosalicylic acid+ 2.1 mL of HCl (37 wt. % in water)	1.33
5-Bromosalicylic acid + 4.2 mL of HCl (37 wt. % in water)	1.03

Table S4. A summary of synthetic conditions, statistical results of NR dimensions (length, width) and comparisons of experimental and calculated LSPR wavelengths for gold NRs synthesized with the addition of extra HCl (37 wt. % in water, 12.1 M).^a

Seed solution (mL)	AgNO ₃ (aq) (mL, mM)	Ascorbic acid (aq) (mL)	HCl (mL, M)	Dimensions ^b measured from TEM (nm)	Dimensions for FDTD calculation	Experimental LSPR peak position (nm)	LSPR peak position from FDTD calculation (nm)
0.8	60.0, 0.43	1.25	2.1, 0.045	71.5 ± 4.5 12.0 ± 1.0	71, 12	979	989
0.4	24.0, 0.18	1.25	2.1, 0.048	101.7 ± 7.5 15.9 ± 0.8	102, 16	1039	1057
0.4	48.0, 0.35	1.25	2.1, 0.046	103.0 ± 8.0 16.3 ± 0.8	103, 16	1058	1062
0.8	24.0, 0.18	1.25	2.1, 0.048	89.6 ± 5.0 11.6 ± 0.6	90, 12	1146	1160
0.2	36.0, 0.27	1.25	4.2, 0.095	109.8 ± 8.0 15.6 ± 1.0	110, 15	1153	1157
0.8	30.0, 0.23	1.25	4.2, 0.095	93.9 ± 11.2 11.0 ± 1.1	94, 11	1246	1272

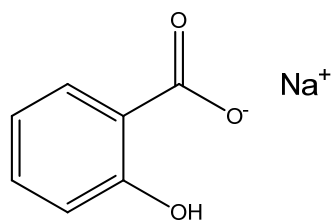
^a The amount of CTAB used for NR growth is 9.0 g and the aromatic additive is 1.1 g of 5-bromosalicylic acid.

^b Dimensions are presented in the format of length (tip-tip distance measured from TEM images) and width. Statistical results are determined from TEM images. At least 100 gold NRs are counted for each set.

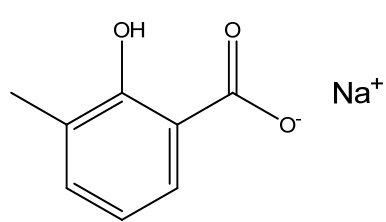
Table S5. Materials cost for gold NR preparation using well-adapted protocols.^a

Chemical	CTAB	HAuCl ₄
Concentration in the NR growth solution	0.1 M	5x10 ⁻⁴ M
Mass (assuming 500 mL NR growth solution)	18.22 g	0.098g
Vendor and price-1	Aldrich (H9151), \$0.83/g	Acros (Reagent ACS), \$72.83/g
Percentage cost-1	67.92%	32.08%
Vendor and price-2	TCI America (H0081), \$0.20/g	Acros (Reagent ACS), \$72.83/g
Percentage cost-2	33.82%	66.18%

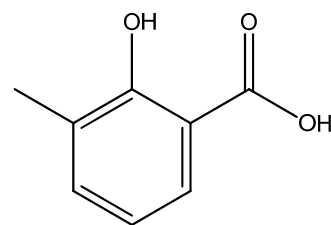
^a It can be clearly seen that the surfactant CTAB accounts for at least one-third and can be as high as two-thirds of the total materials cost in the well-adapted protocols using 0.1 M CTAB in the NR growth solution.



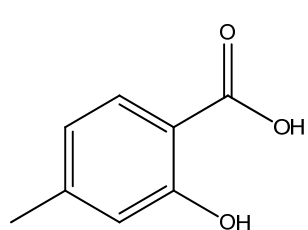
Sodium Salicylate



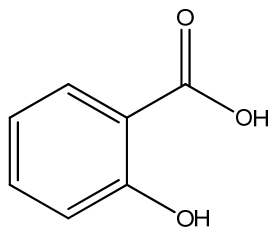
Sodium 3-methylsalicylate



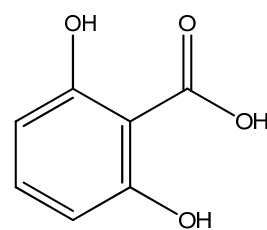
3-Methylsalicylic acid



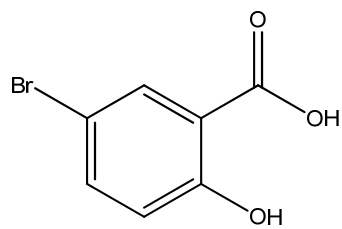
4-Methylsalicylic acid



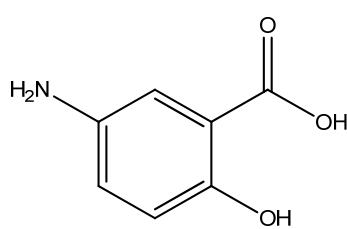
Salicylic acid



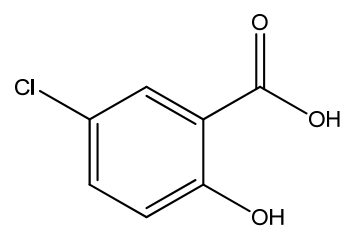
2,6-Dihydroxybenzoic acid



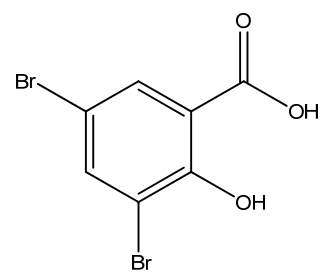
5-Bromosalicylic acid



5-Aminosalicylic acid



5-Chlorosalicylic acid



3,5-Dibromosalicylic acid

Figure S1. Chemical structures of various aromatic additives used for gold NR synthesis.

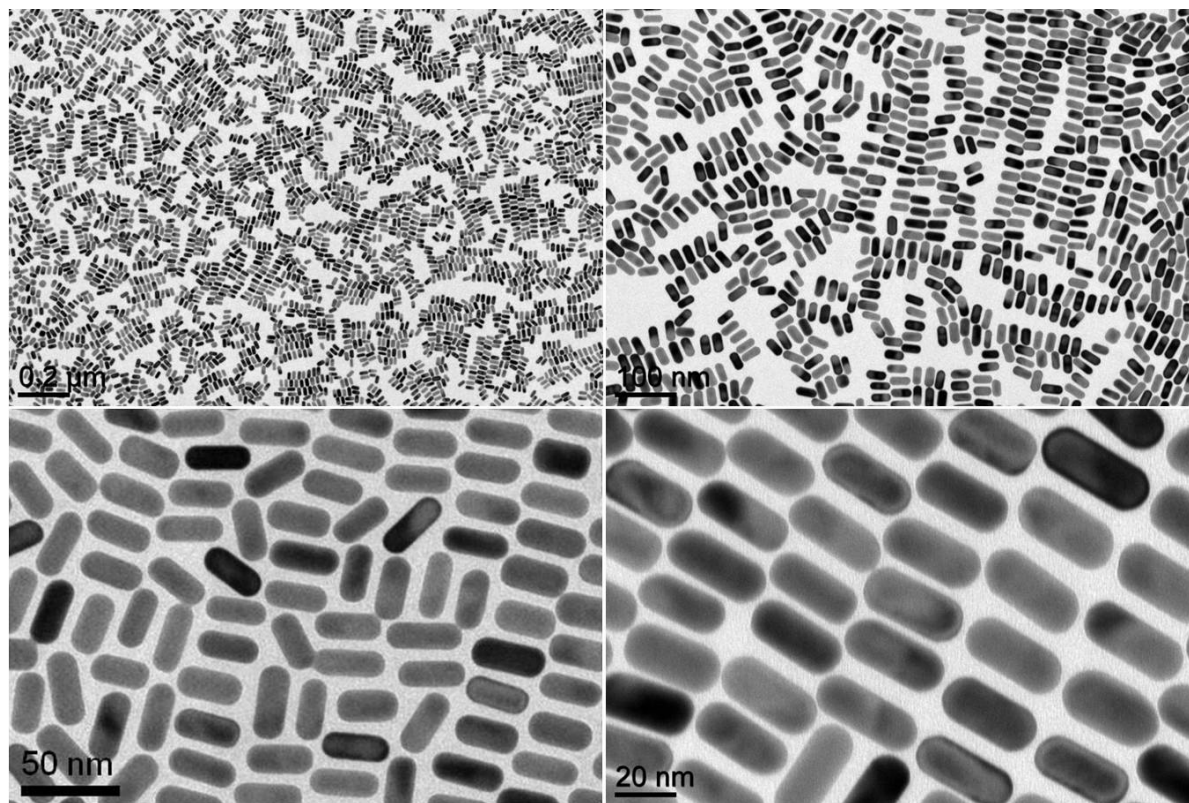


Figure S2. Additional TEM images of gold NRs synthesized under conditions specified in Table S1 using sodium 3-methylsalicylate as the additive.

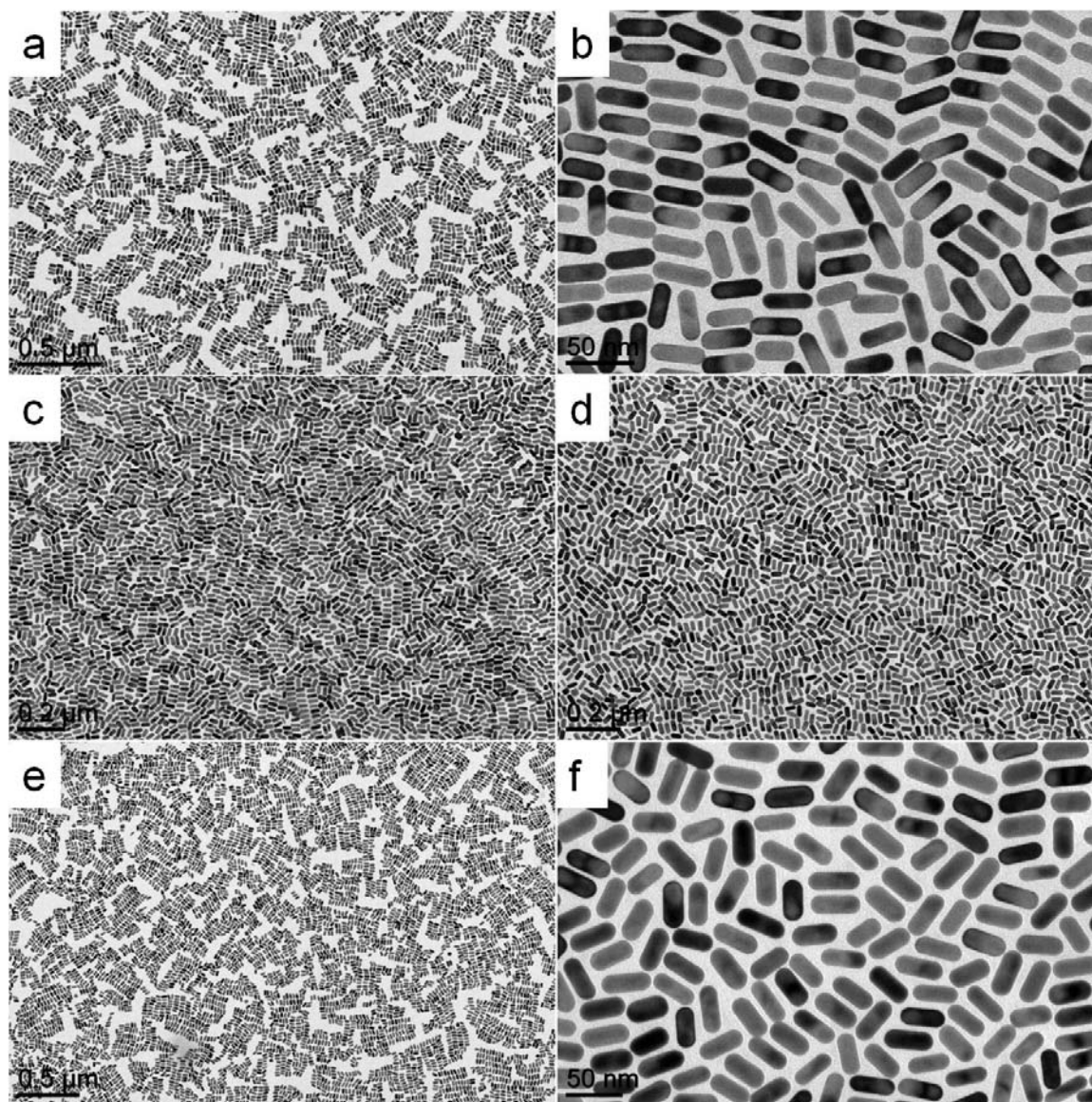


Figure S3. TEM images of three different batches of gold NRs synthesized under conditions specified in Table S1 using sodium salicylate as the additive. (a, b) batch 1, (c, d) batch 2 and (e, f) batch 3.

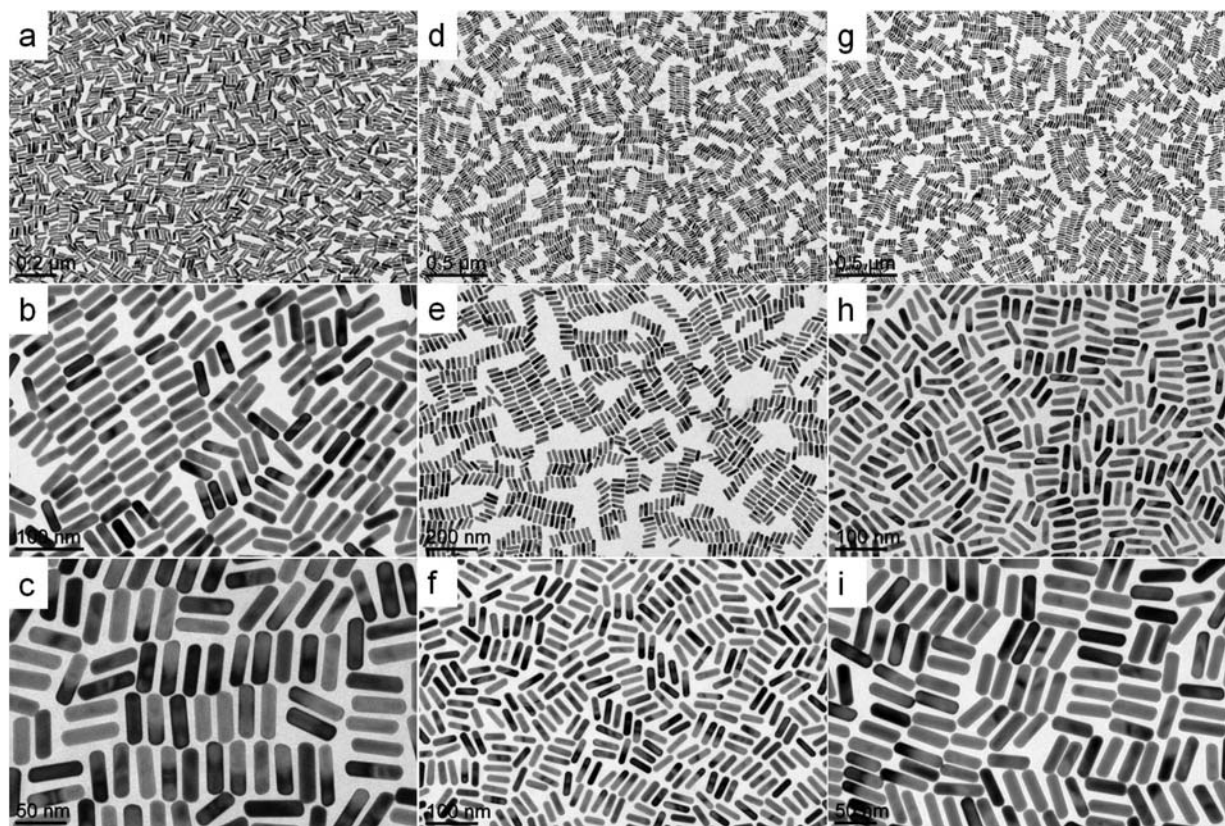


Figure S4. TEM images of three different batches of gold NRs synthesized under conditions specified in Table S1 using 5-bromosalicylic acid as the additive. (a-c) batch 1, (d-f) batch 2 and (g-i) batch 3.

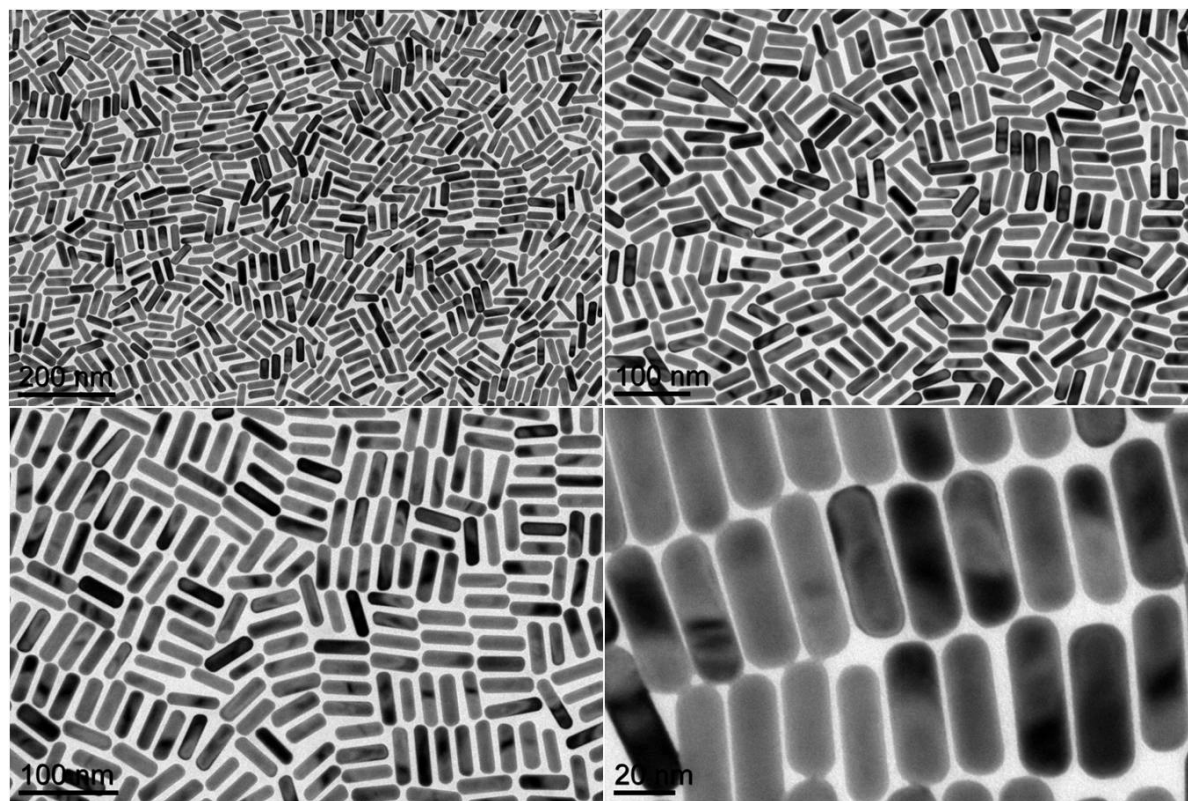


Figure S5. Additional TEM images of gold NRs synthesized under conditions specified in Table S1 using 2,6-dihydroxybenzoic acid as the additive.

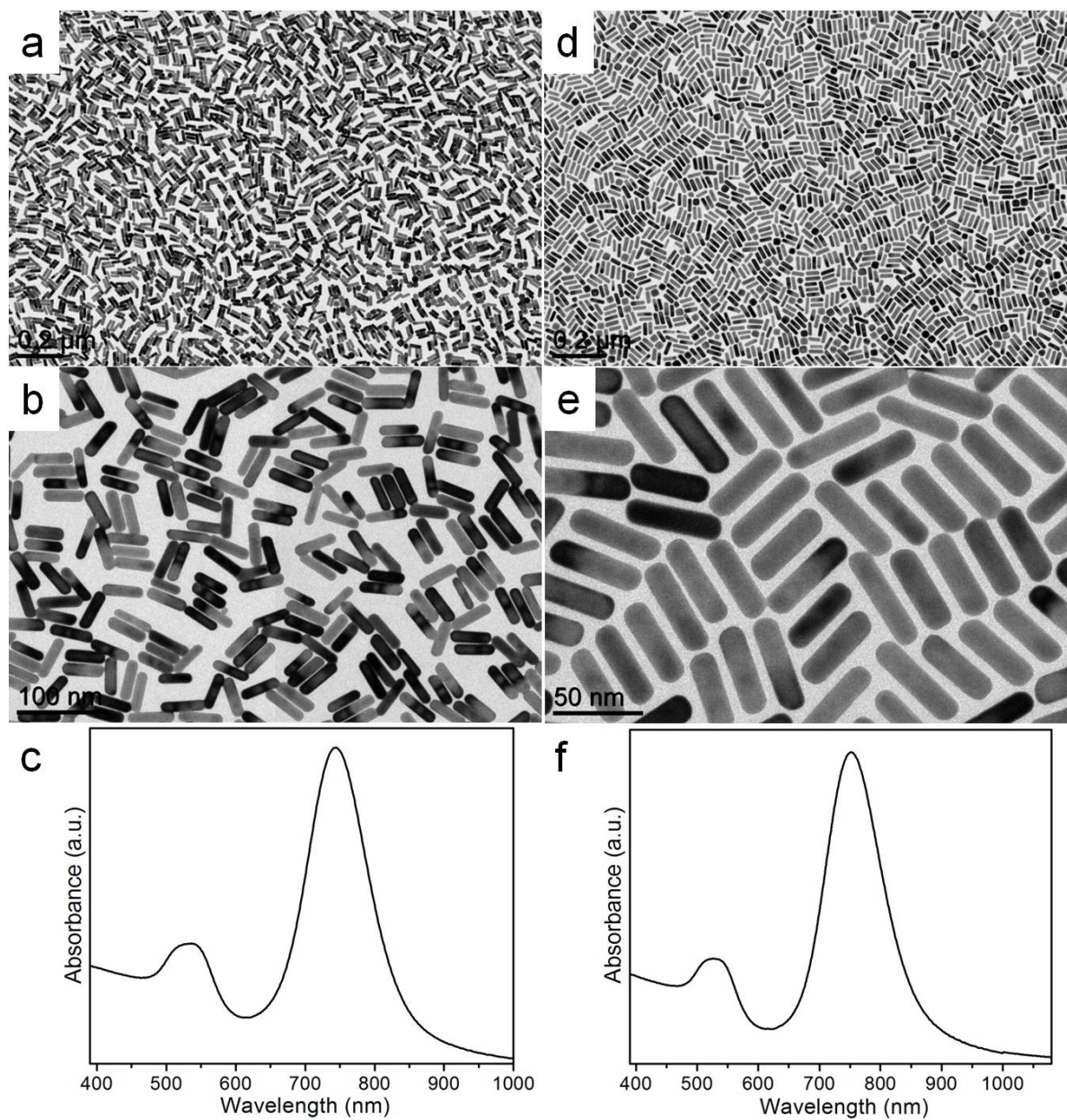


Figure S6. TEM images and the corresponding UV-Vis-NIR spectrum of two different batches of gold NRs synthesized under conditions specified in Table S1 using 4-methylsalicylic acid as the additive. (a-c) batch 1 and (d-f) batch 2.

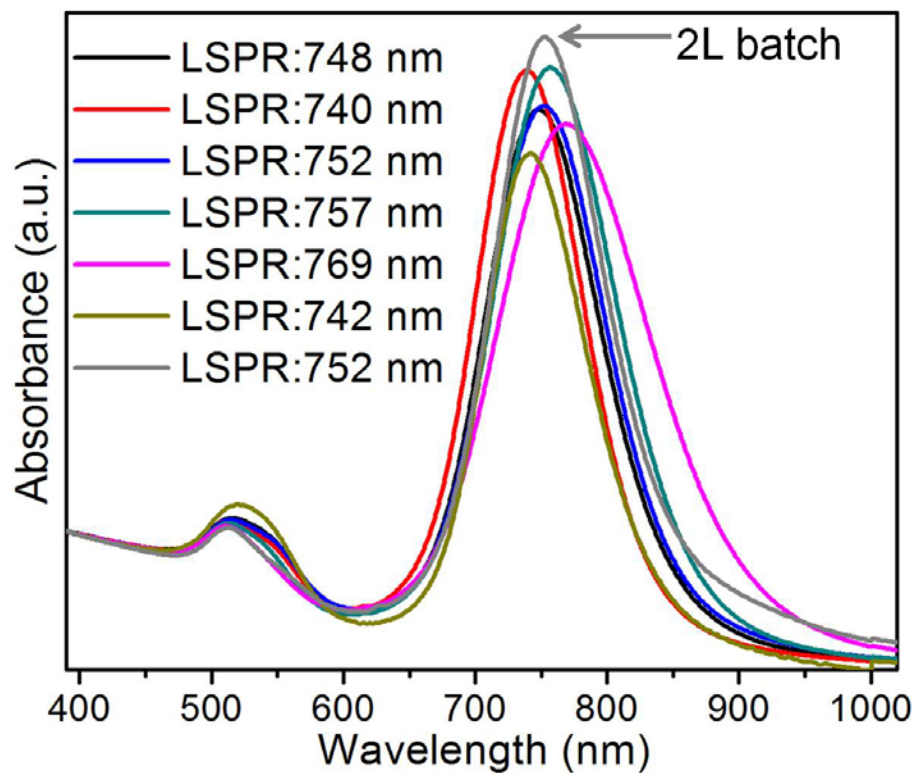


Figure S7. UV-Vis-NIR spectra of six different batches (500mL scale of reaction) and one scale-up batch (2L scale of reaction) of gold NRs synthesized under conditions specified in Table S1 using 5-bromosalicylic acid as the additive. Each spectrum is normalized by its absorption at 400 nm.

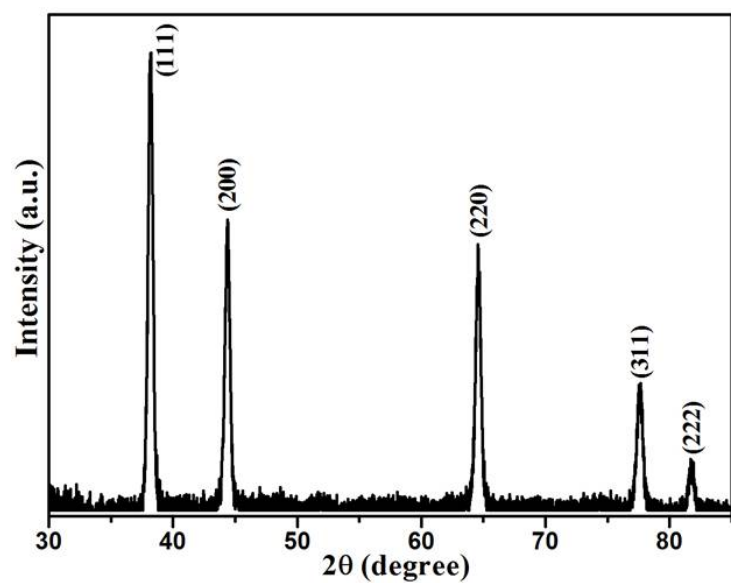


Figure S8. Powder XRD pattern of gold NRs synthesized under conditions specified in Table S1 using 5-bromosalicylic acid as the additive.

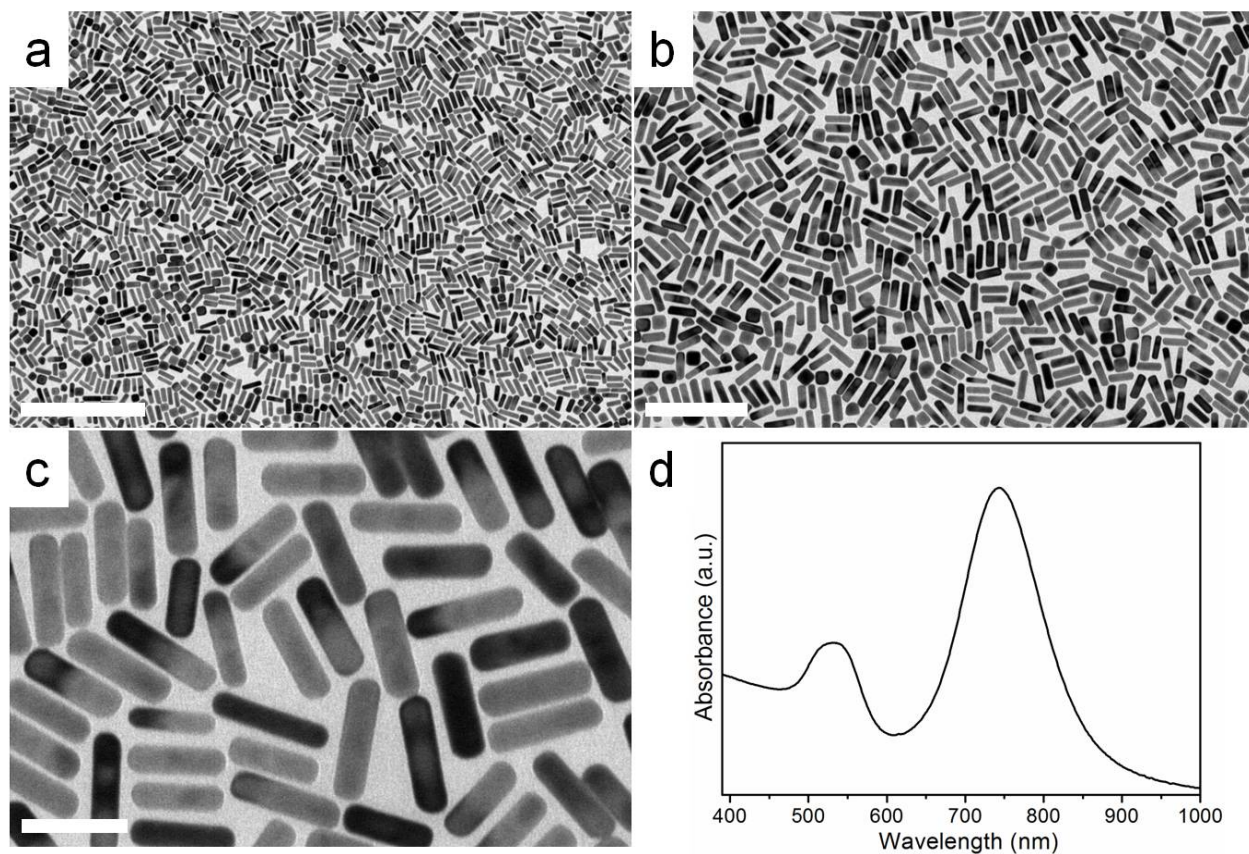


Figure S9. (a-c) TEM images and (d) UV-Vis-NIR spectrum of gold NRs synthesized under conditions specified in Table S1 using 3-methylsalicylic acid as the additive. Scale bars: a) 400 nm, b) 200 nm, c) 50 nm.

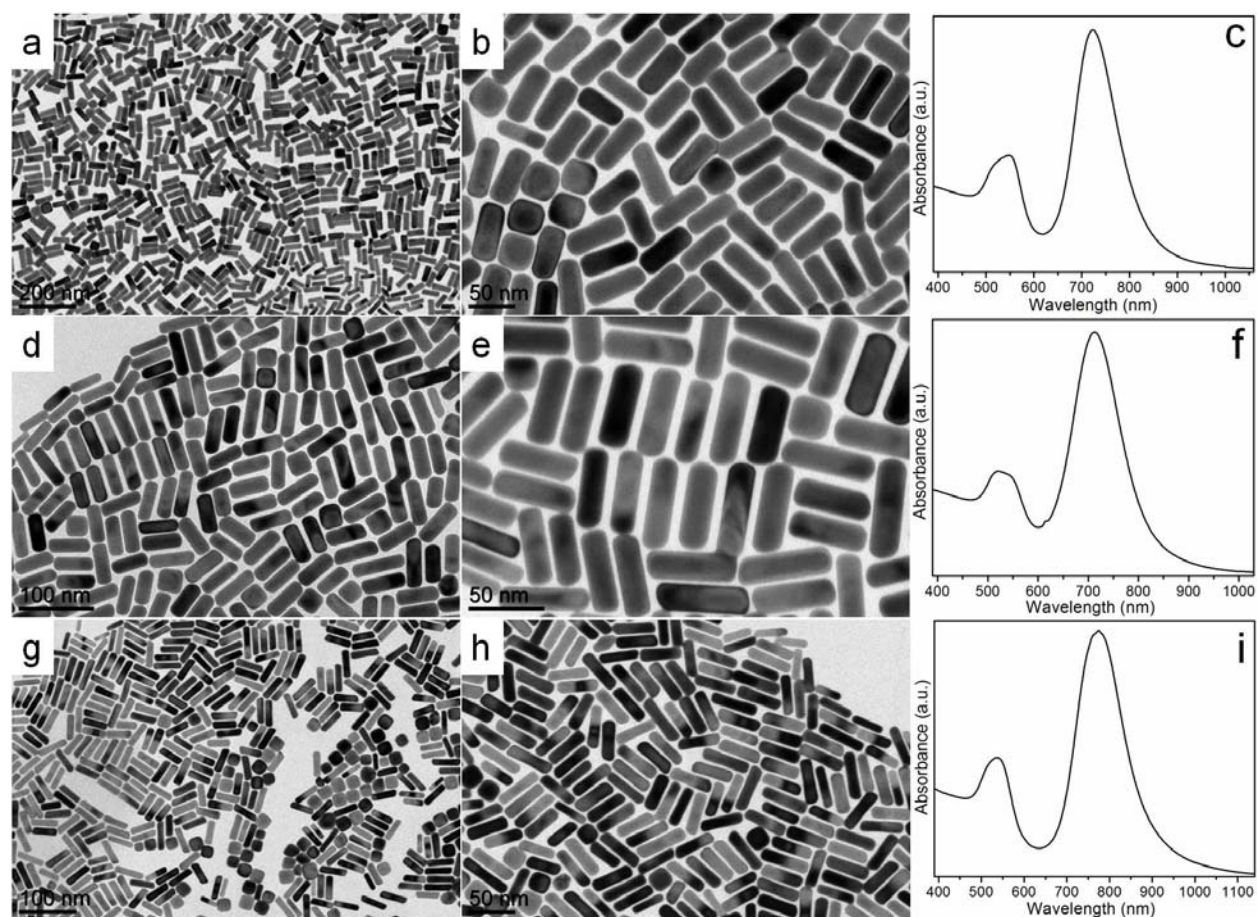


Figure S10. TEM images and the corresponding UV-Vis-NIR spectrum of three different batches of gold NRs synthesized under conditions specified in Table S1 using salicylic acid as the additive. (a-c) batch 1, (d-f) batch 2 and (g-i) batch 3.

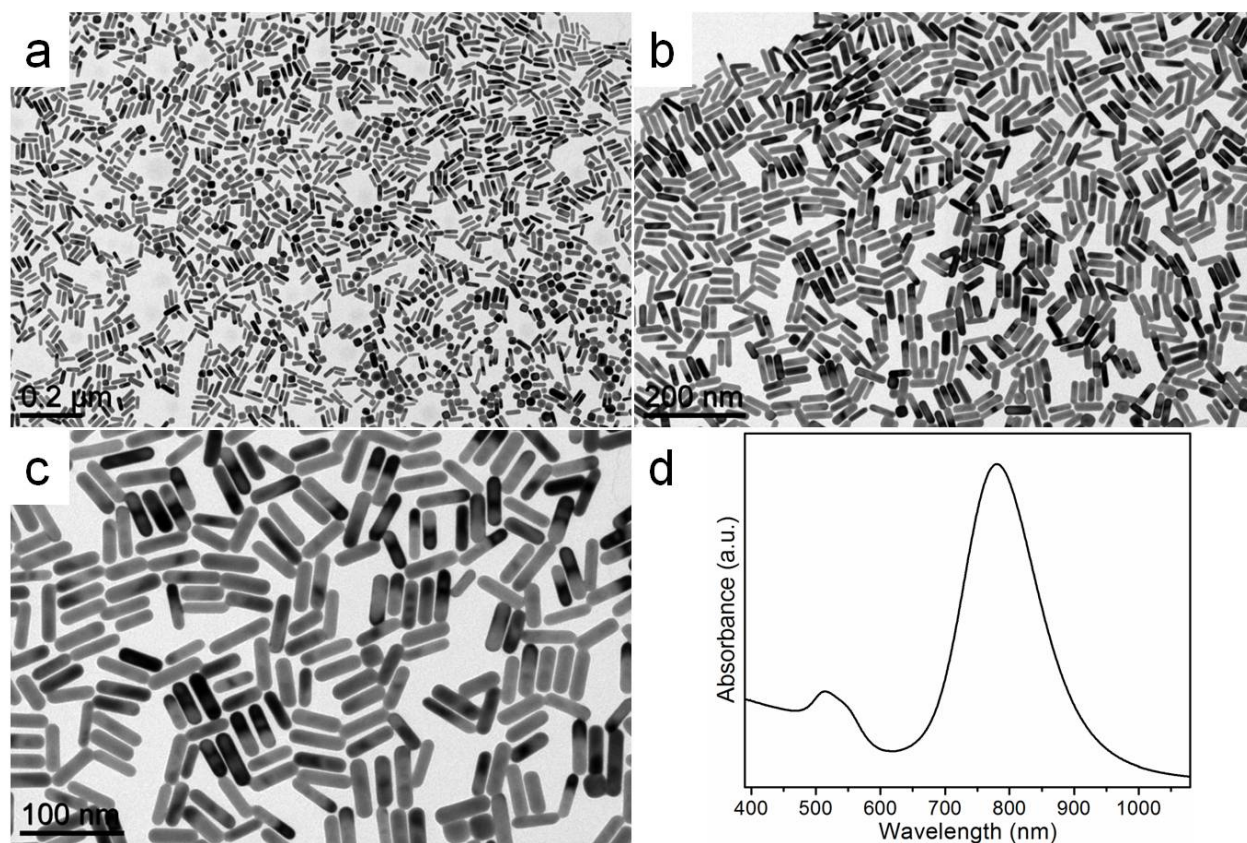


Figure S11. (a-c) TEM images and (d) UV-Vis-NIR spectrum of gold NRs synthesized under conditions specified in Table S1 using 5-chlorosalicylic acid as the additive.

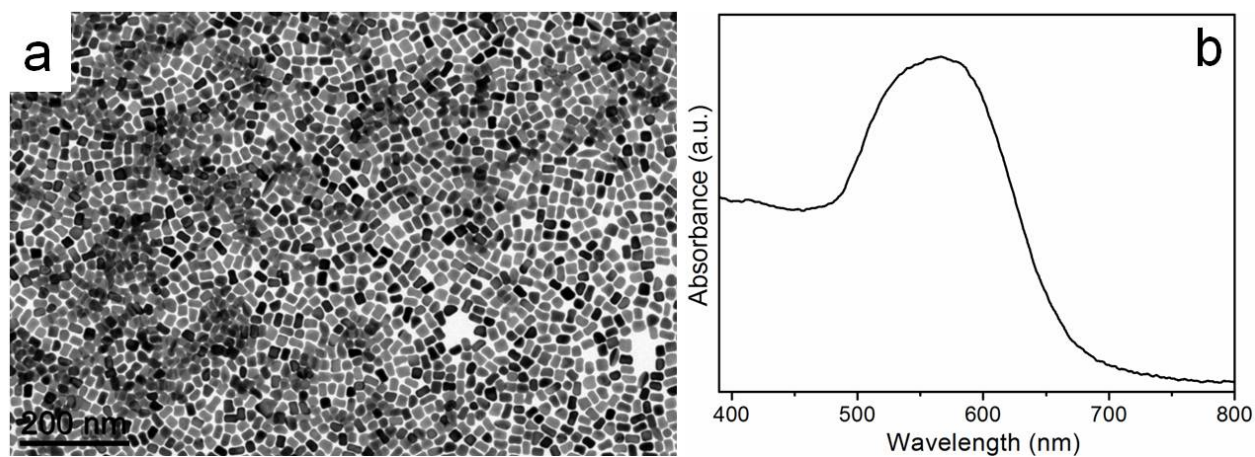


Figure S12. (a) TEM image and (b) UV-Vis-NIR spectrum of gold NRs synthesized under conditions specified in Table S1 using 5-aminosalicylic acid as the additive.

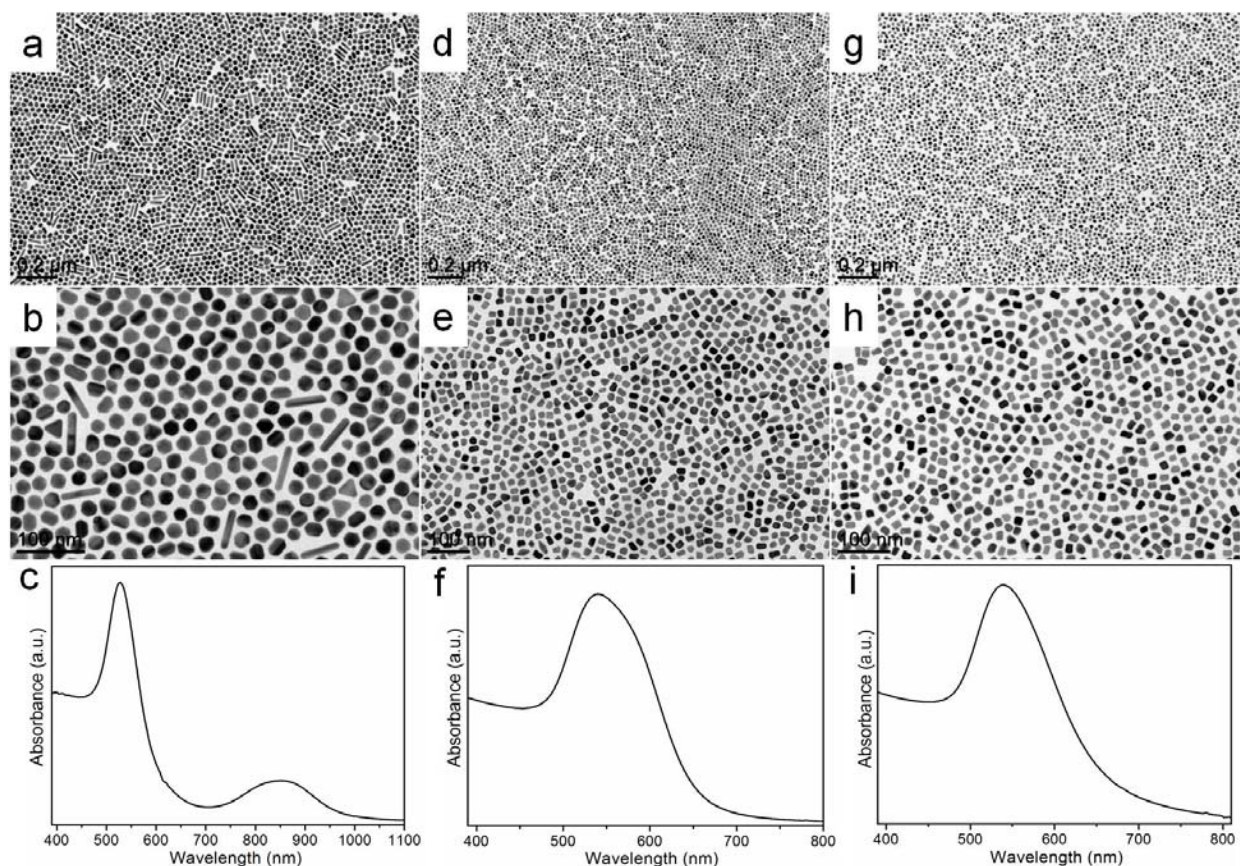


Figure S13. Variations in gold NR growth condition for the CTAB-5-aminosalicylic acid system. (a-b) TEM images and (c) UV-Vis-NIR spectrum of gold NRs synthesized under conditions specified in Table S1 using 5-aminosalicylic acid as the additive except that no $\text{AgNO}_3(\text{aq})$ is present in the growth solution. (d-e) TEM images and (f) UV-Vis-NIR spectrum of gold NRs synthesized under conditions specified in Table S1 using 5-aminosalicylic acid as the additive except with 1 mL of 0.064 M ascorbic acid solution. (g-h) TEM images and (i) UV-Vis-NIR spectrum of gold NRs synthesized under conditions specified in Table S1 using 5-aminosalicylic acid as the additive except with 1 mL of 0.064 M ascorbic acid solution and 3.5 g of CTAB.

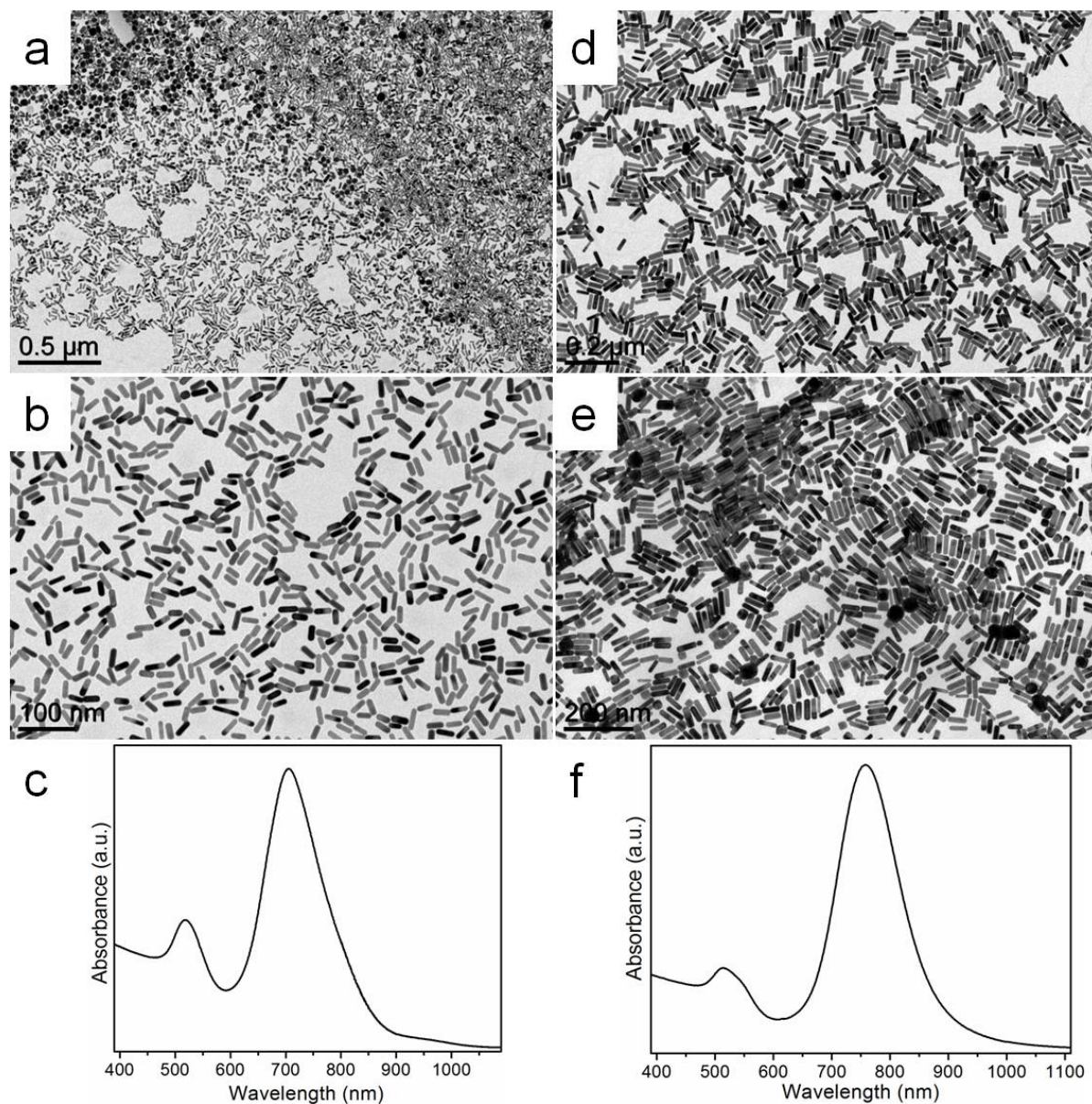


Figure S14. TEM images and the corresponding UV-Vis-NIR spectrum of gold NRs synthesized under conditions specified in Table S1 using (a-c) 0.8 g and (d-f) 1.2 g of 3,5-dibromosalicylic acid as the additive.

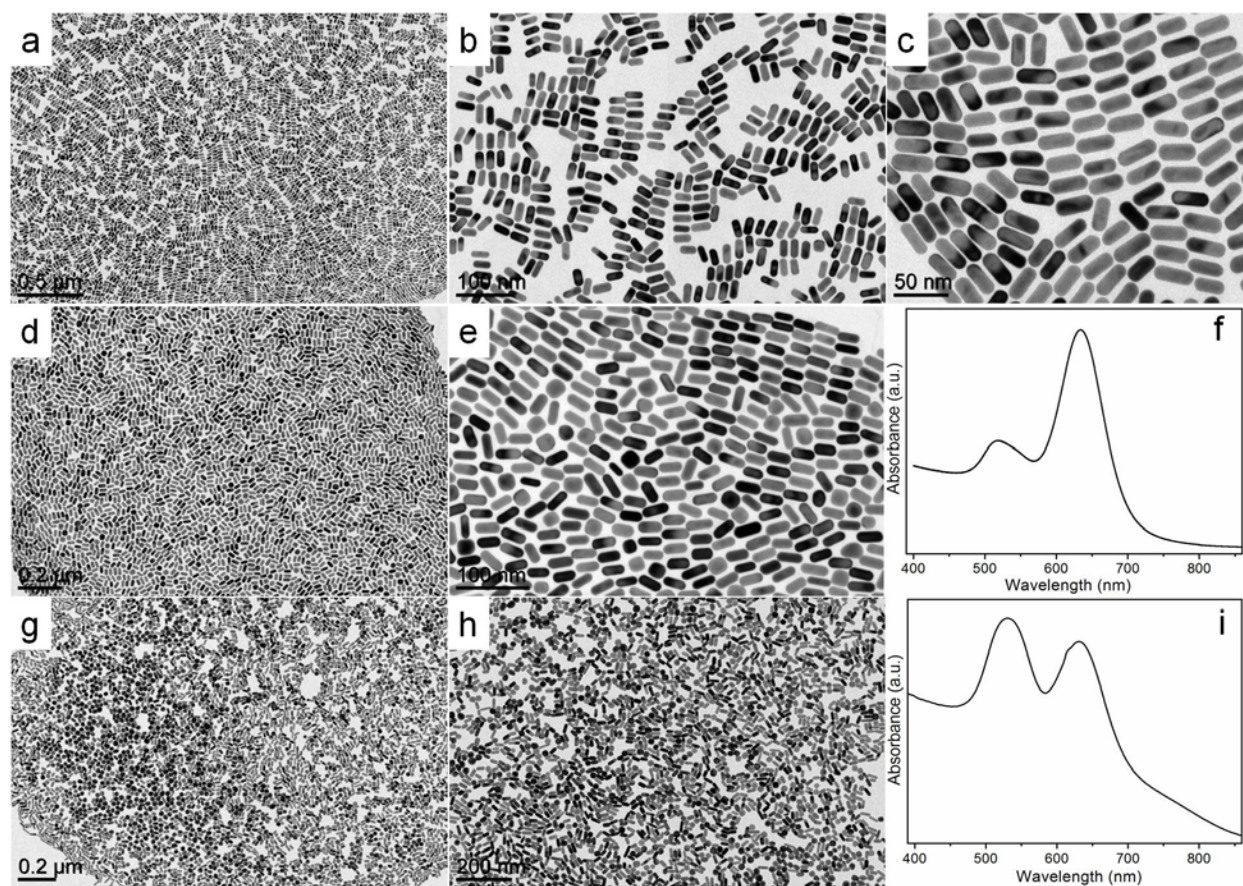


Figure S15. The effect of increasing silver ion concentration in the gold NR growth solution for the CTAB-sodium 3-methylsalicylate system. (a-c) TEM images of gold NRs synthesized under conditions specified in Table S1 using sodium 3-methylsalicylate as the additive except with 9 mL of 4 mM AgNO_3 solution. (d, e) TEM images and (f) UV-Vis-NIR spectrum of gold NRs synthesized under conditions specified in Table S1 using sodium 3-methylsalicylate as the additive except with 12 mL of 4 mM AgNO_3 solution. (g, h) TEM images and (i) UV-Vis-NIR spectrum of gold NRs synthesized under conditions specified in Table S1 using sodium 3-methylsalicylate as the additive except with 24 mL of 4 mM AgNO_3 solution. The relative peak intensities of the two plasmonic resonances indicate increased amount of spherical gold nanoparticles present in the samples as more AgNO_3 solution is used in the NR growth solution.

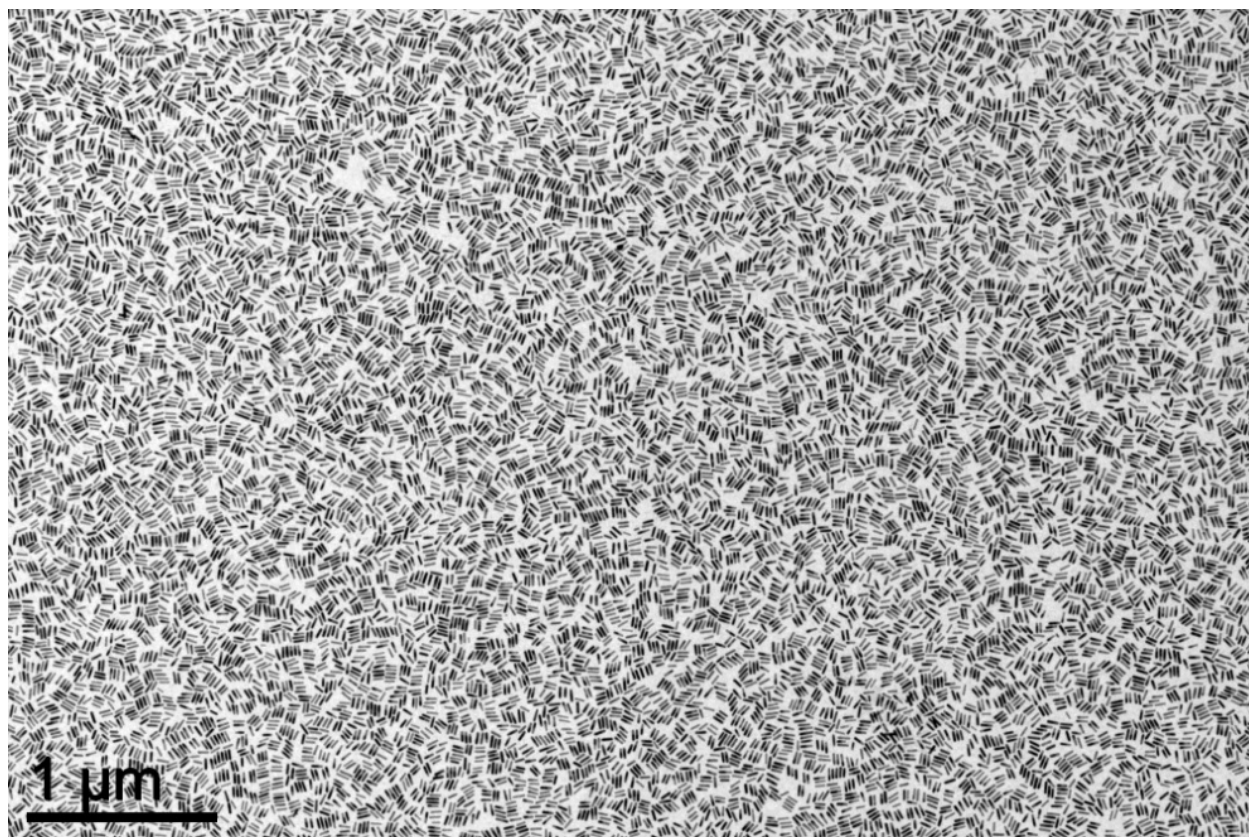


Figure S16. Large area TEM image of gold NRs synthesized under conditions specified in Table S1 using 5-bromosalicylic acid as the additive except with 0.4 mL of seed solution and 18 mL of 4 mM AgNO_3 solution.

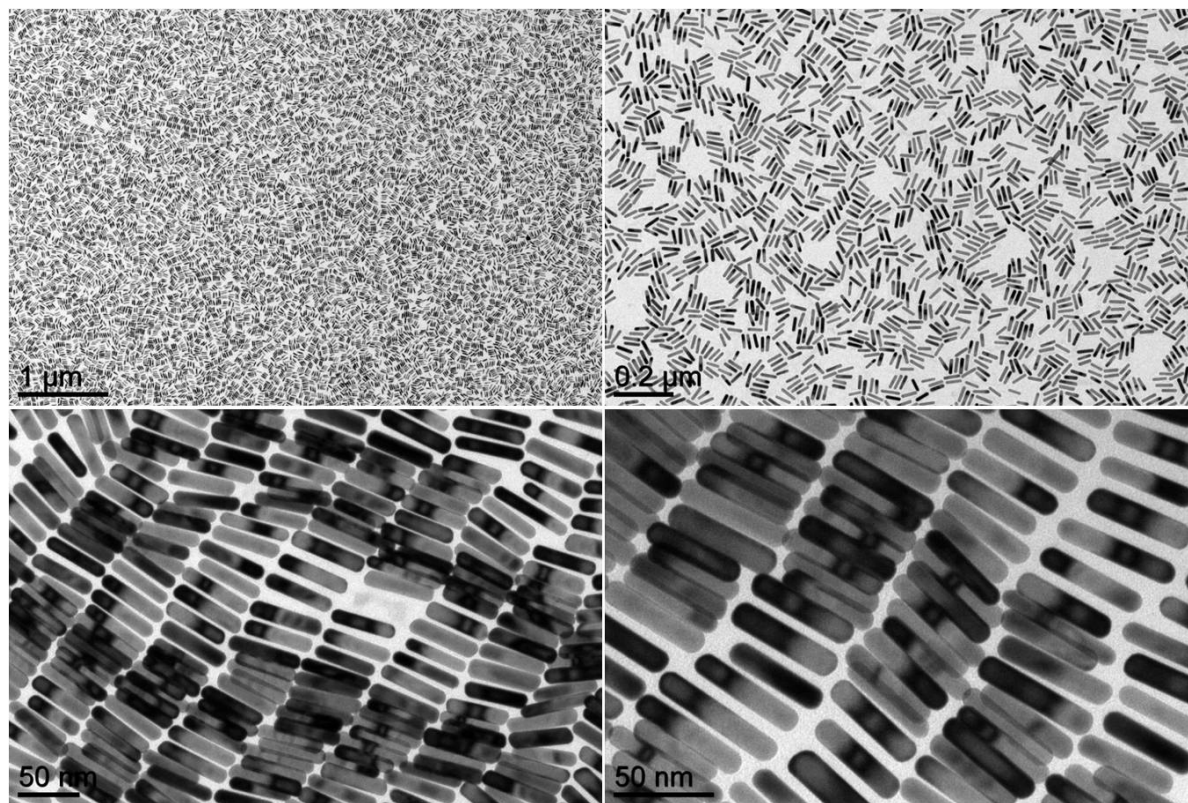


Figure S17. Additional TEM images of gold NRs synthesized under conditions specified in Table S1 using 5-bromosalicylic acid as the additive except with 0.4 mL of seed solution and 18 mL of 4 mM AgNO₃ solution.

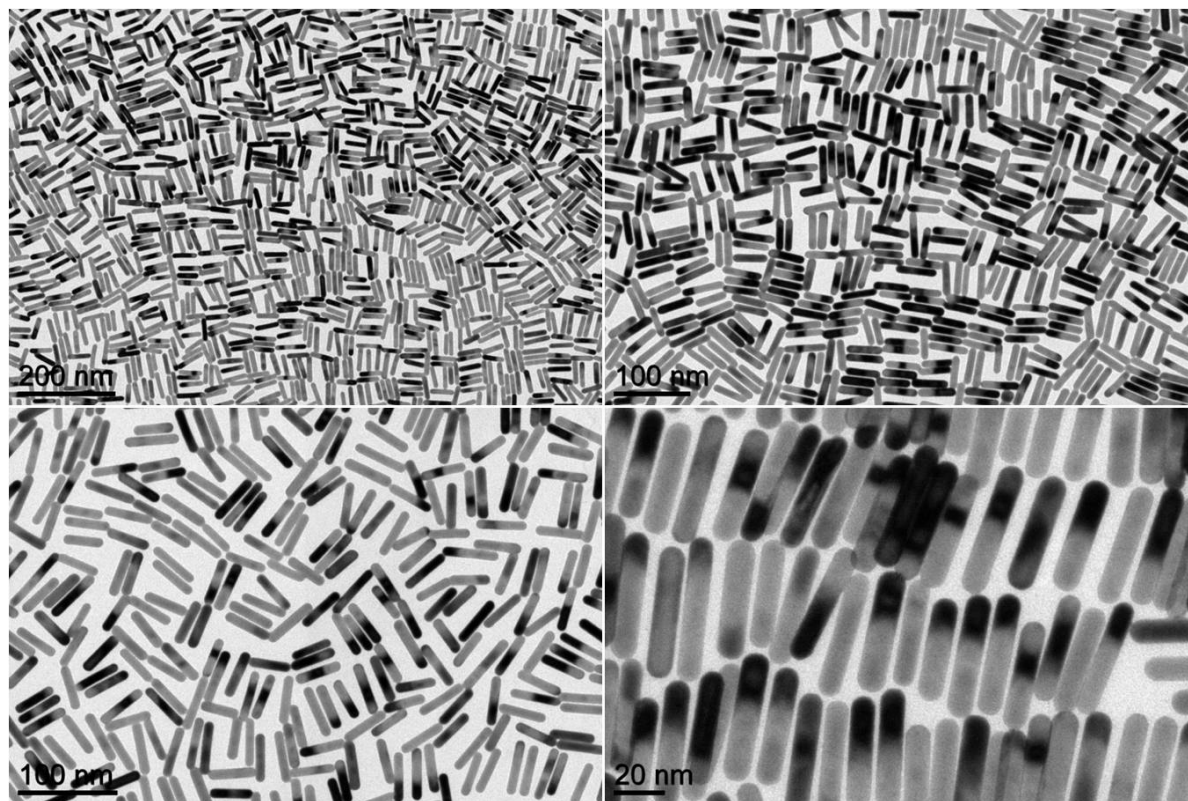


Figure S18. Additional TEM images of gold NRs synthesized under conditions specified in Table S1 using 5-bromosalicylic acid as the additive except with 24 mL of 4 mM AgNO_3 solution.

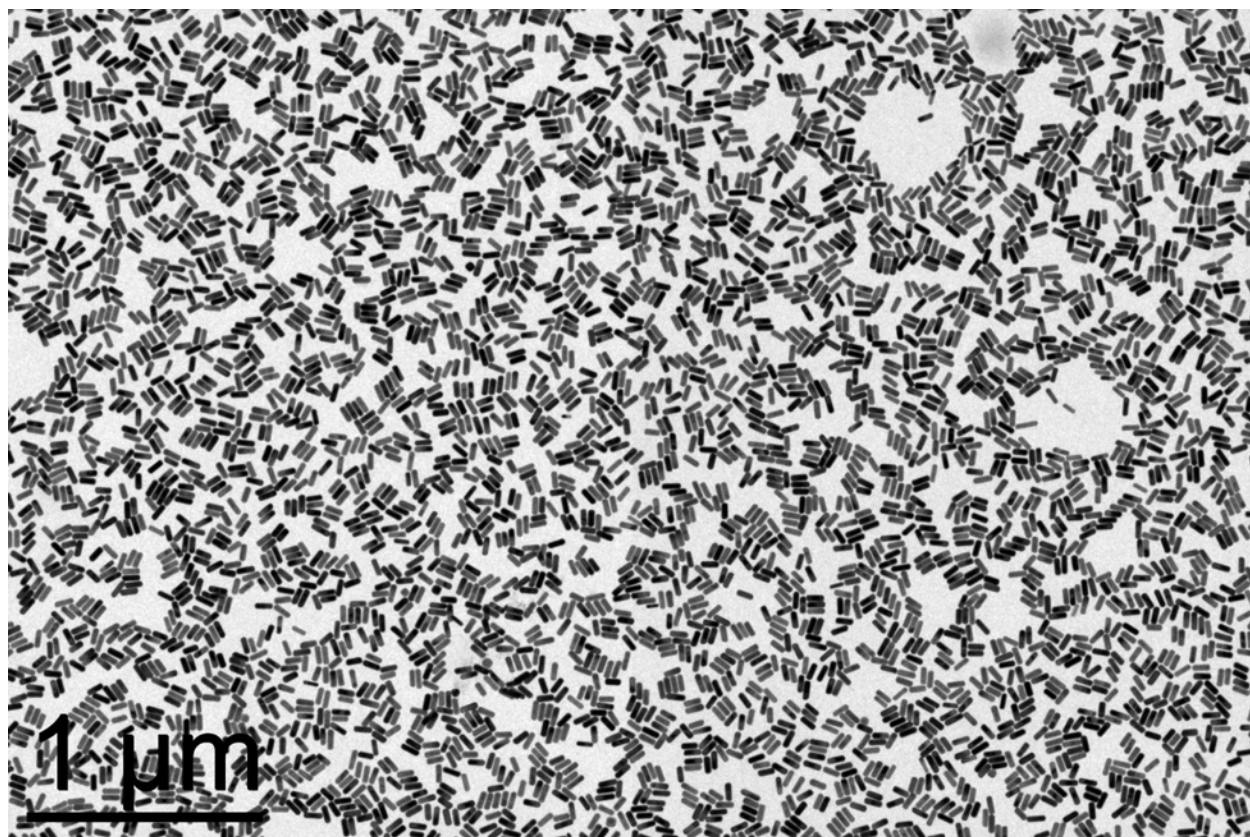


Figure S19. Large area TEM image of gold NRs synthesized under conditions specified in Table S1 using 5-bromosalicylic acid as the additive except with 0.2 mL of seed solution.

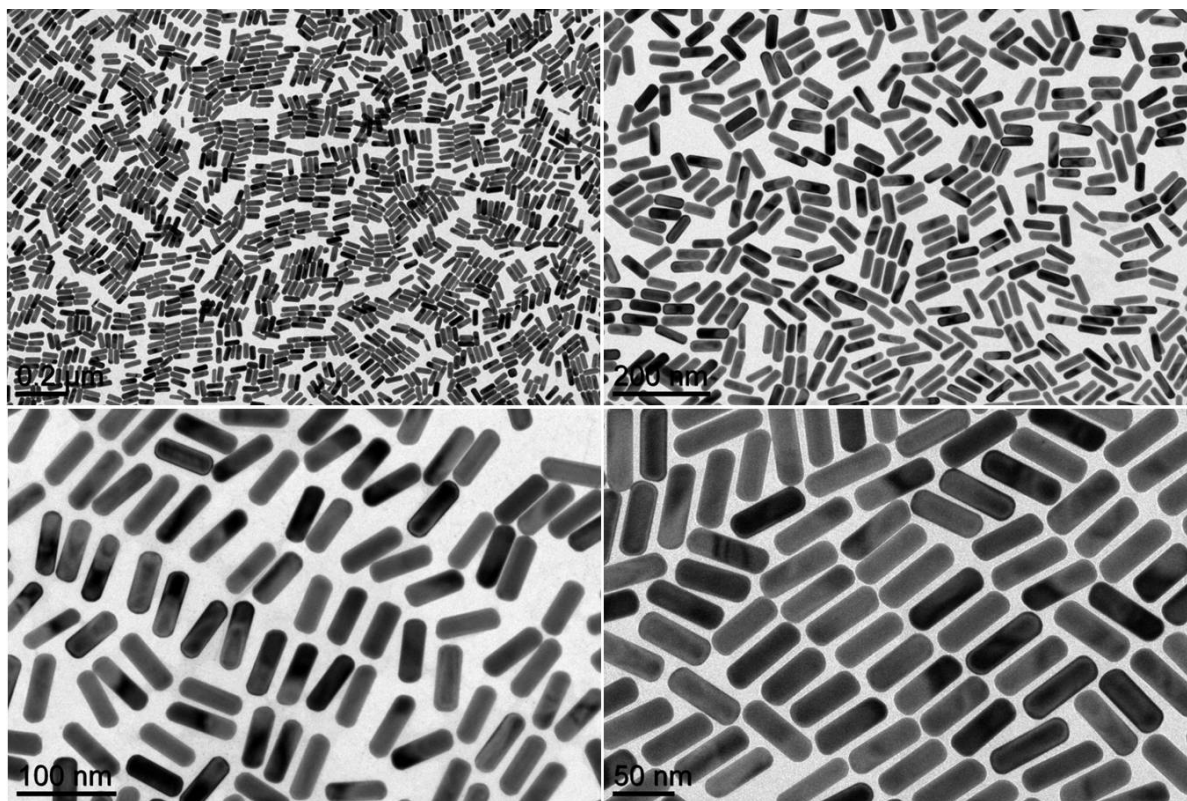


Figure S20. Additional TEM images of gold NRs synthesized under conditions specified in Table S1 using 5-bromosalicylic acid as the additive except with 0.2 mL of seed solution.

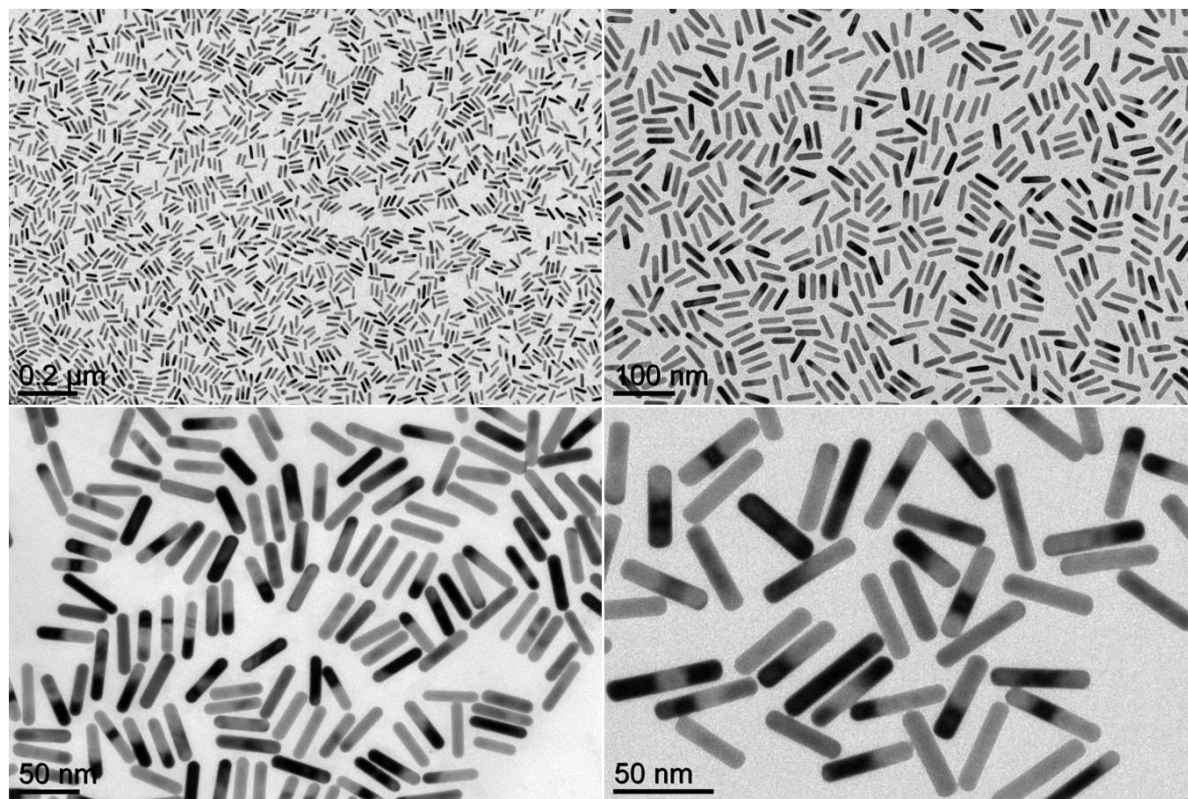


Figure S21. Additional TEM images of gold NRs synthesized under conditions specified in Table S1 using 5-bromosalicylic acid as the additive except with 0.4 mL of seed solution.

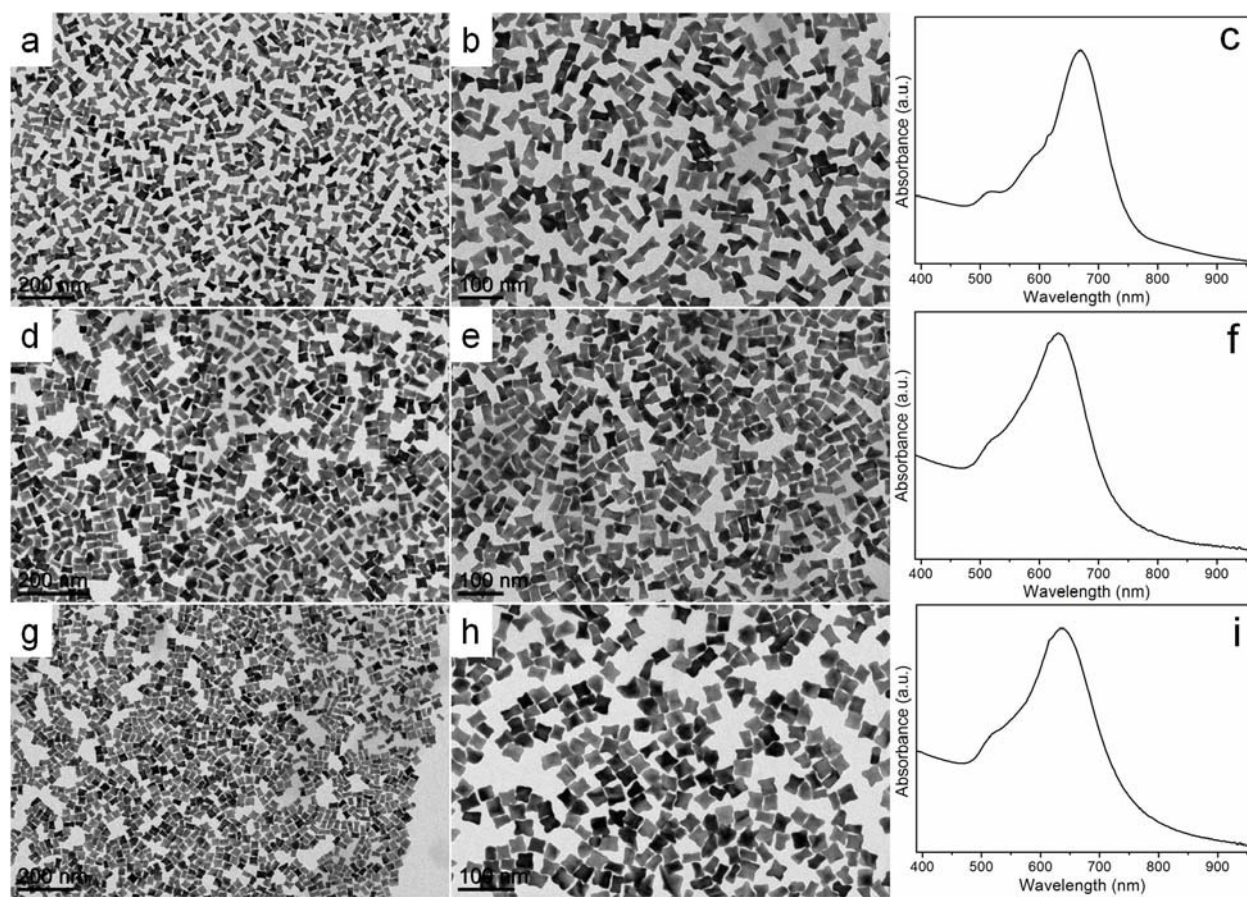


Figure S22. The effect of increasing ascorbic acid and silver ion concentration in the gold NR growth solution for the CTAB-sodium 3-methylsalicylate system. (a, b) TEM images and (c) UV-Vis-NIR spectrum of gold NRs synthesized under conditions specified in Table S1 using sodium 3-methylsalicylate as the additive except with 3 mL of 0.064 M ascorbic acid solution. (d, e) TEM images and (f) UV-Vis-NIR spectrum of gold NRs synthesized under conditions specified in Table S1 using sodium 3-methylsalicylate as the additive except with 3 mL of 0.064 M ascorbic acid solution and 12 mL of 4 mM AgNO_3 solution. (g, h) TEM images and (i) UV-Vis-NIR spectrum of gold NRs synthesized under conditions specified in Table S1 using sodium 3-methylsalicylate as the additive except with 4 mL of 0.064 M ascorbic acid solution and 12 mL of 4 mM AgNO_3 solution.

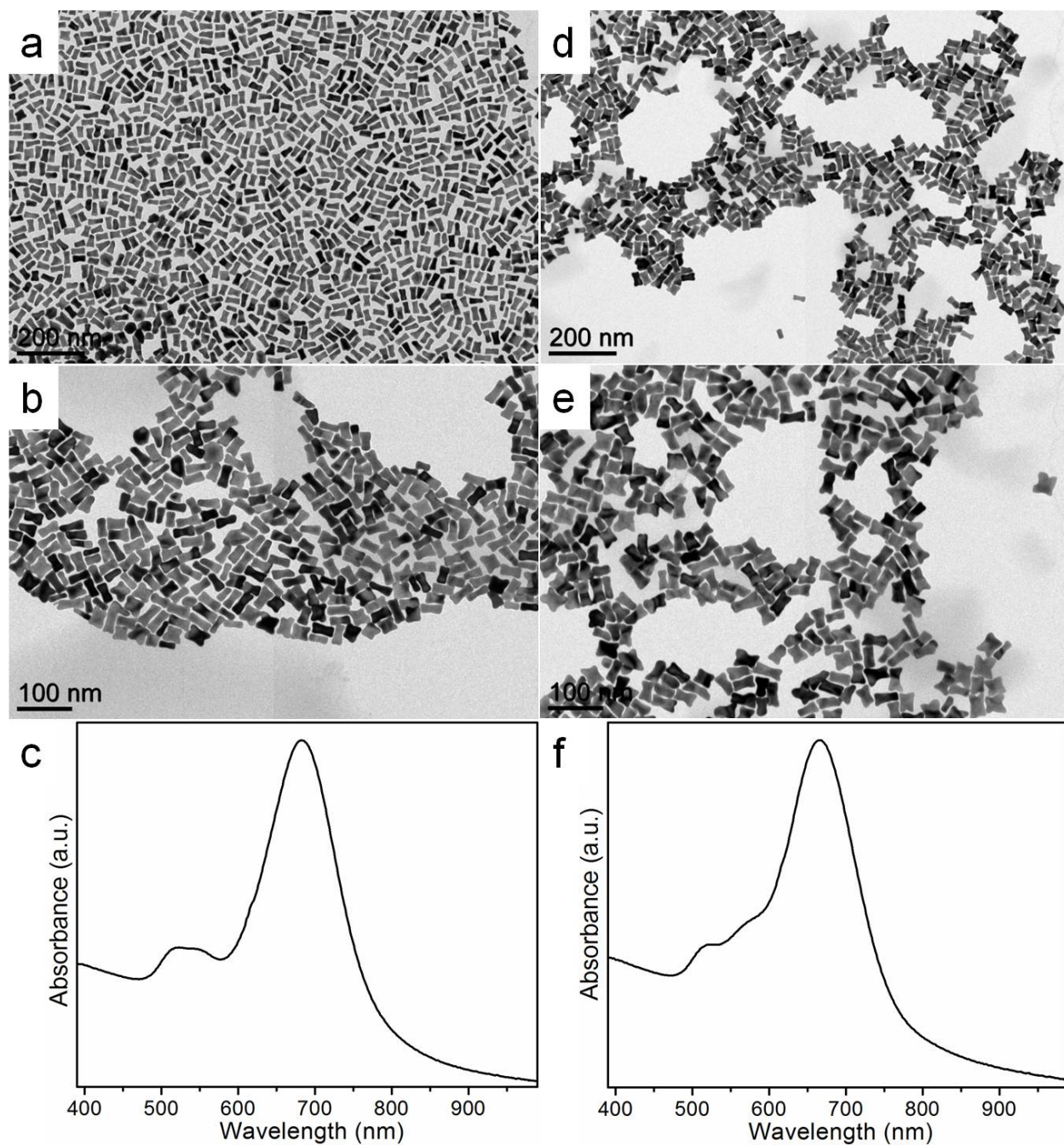


Figure S23. The effect of increasing ascorbic acid concentration in the gold NR growth solution for the CTAB-sodium salicylate system. (a, b) TEM images and (c) UV-Vis-NIR spectrum of gold NRs synthesized under conditions specified in Table S1 using sodium salicylate as the additive except with 2 mL of 0.064 M ascorbic acid solution. (d, e) TEM images and (c) UV-Vis-NIR spectrum of gold NRs synthesized under conditions specified in Table S1 using sodium salicylate as the additive except with 3 mL of 0.064 M ascorbic acid solution.

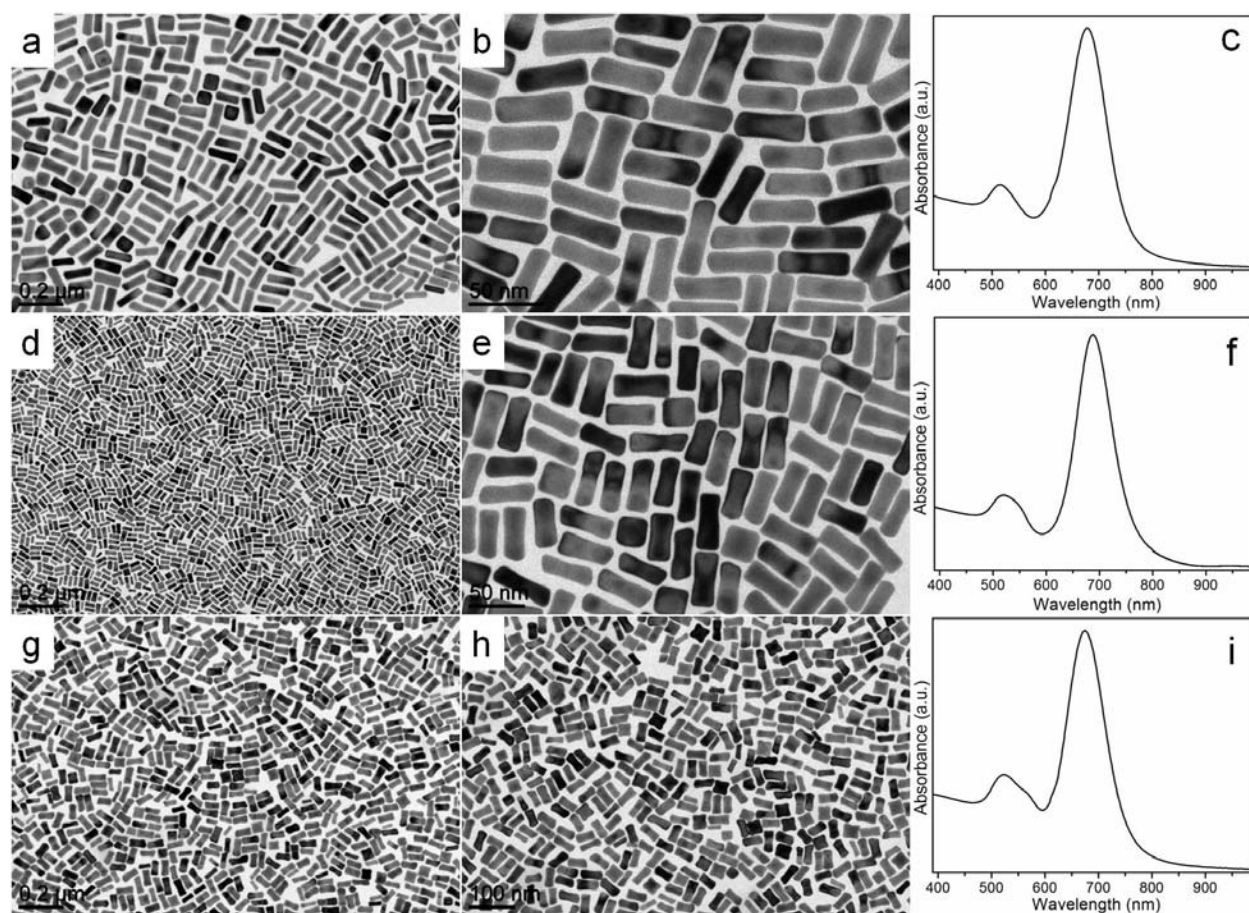


Figure S24. The effect of increasing ascorbic acid concentration in the gold NR growth solution for the CTAB-5-bromosalicylic acid system. TEM images and the corresponding UV-Vis-NIR spectrum of gold NRs synthesized under conditions specified in Table S1 using 5-bromosalicylic acid as the additive except with (a-c) 3 mL, (d-f) 4 mL and (g-i) 4.5 mL of 0.064 M ascorbic acid solution.

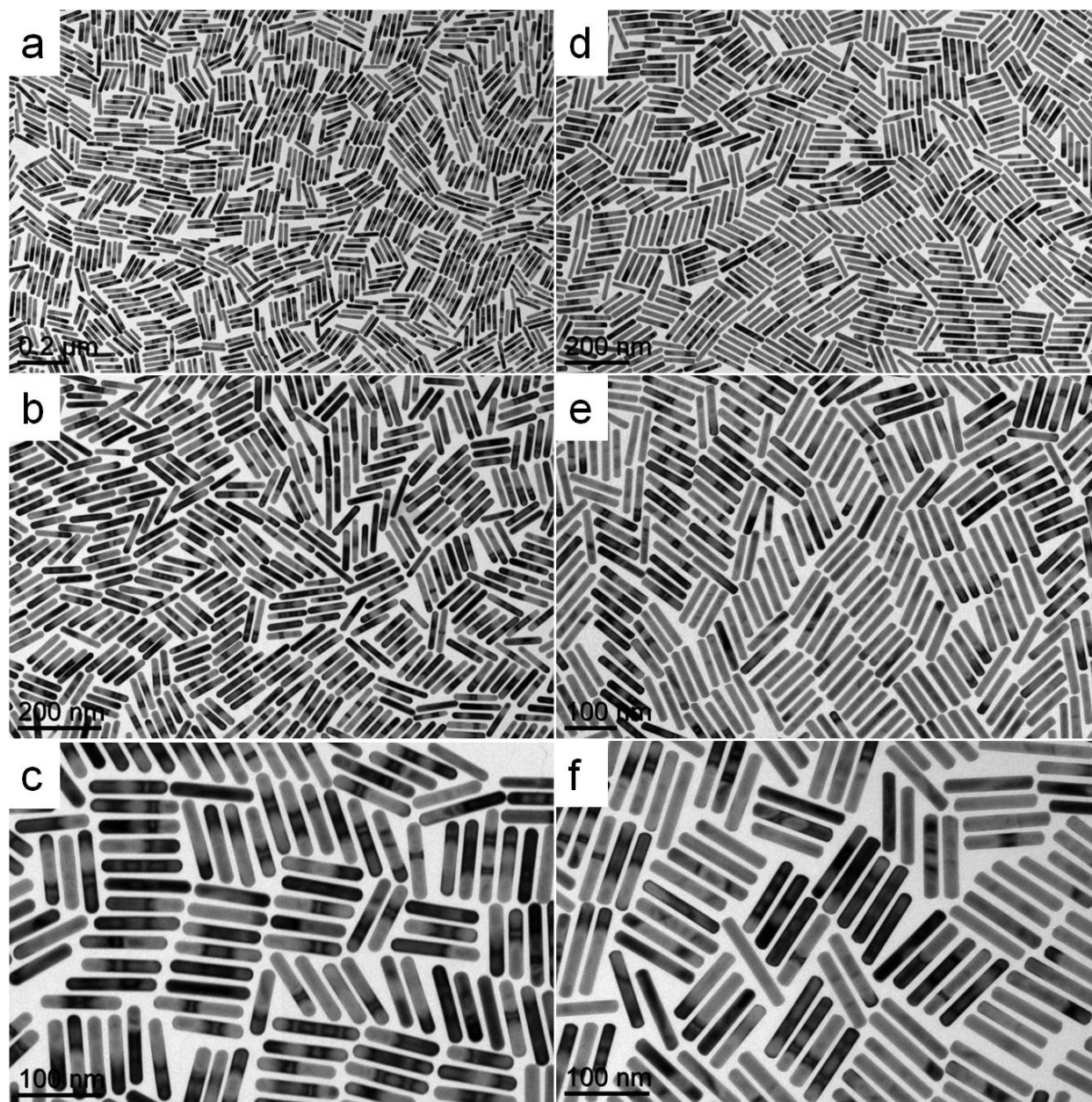


Figure S25. (a-c) Additional TEM images of gold NRs synthesized with 0.4 mL of seed solution, 24 mL of 4 mM AgNO_3 solution and 2.1 mL of HCl (12.1 M). (d-f) Additional TEM images of gold NRs synthesized with 0.4 mL of seed solution, 48 mL of 4 mM AgNO_3 solution and 2.1 mL of HCl (12.1 M).

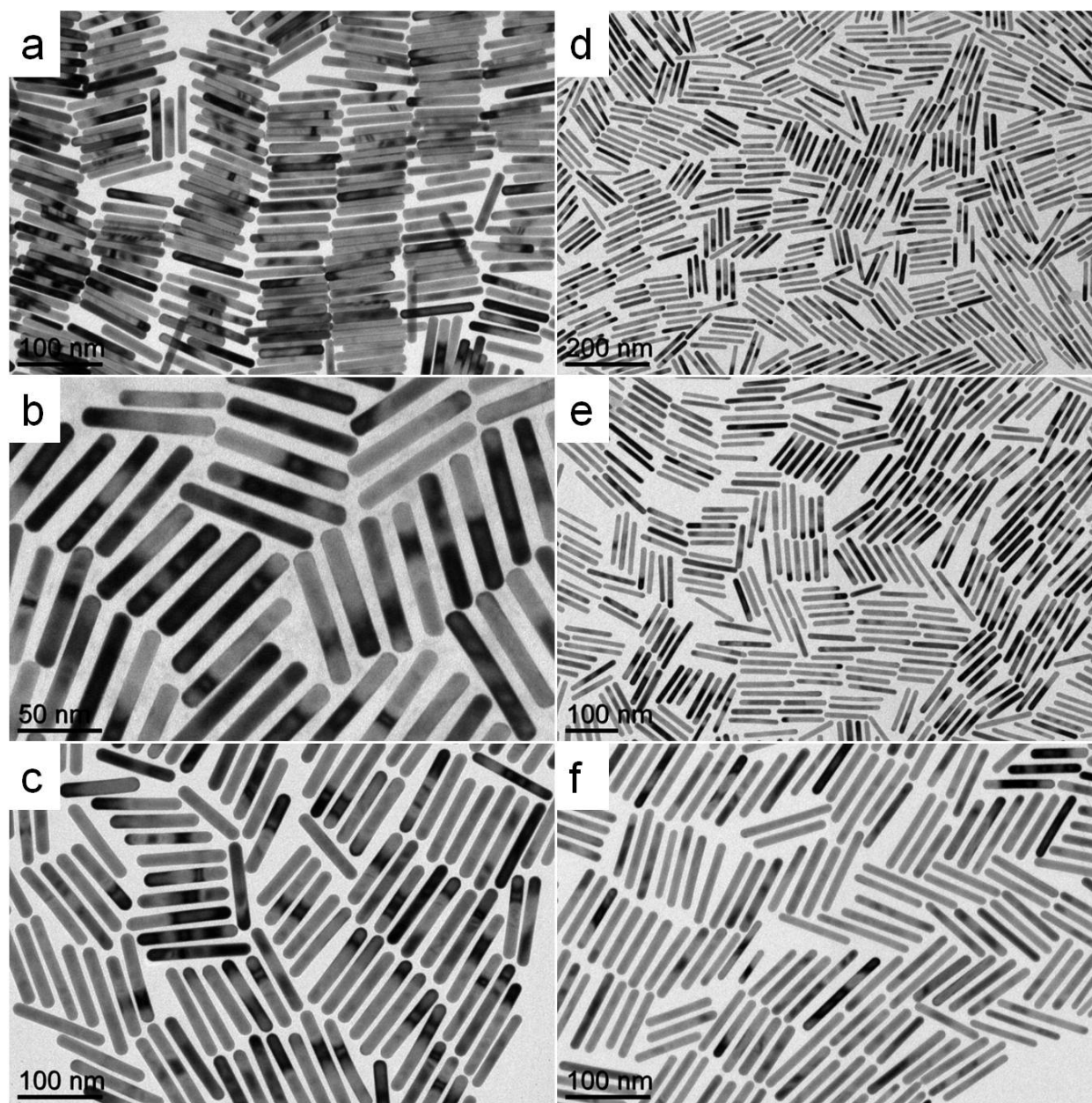


Figure S26. (a-c) Additional TEM images of gold NRs synthesized with 0.2 mL of seed solution, 36 mL of 4 mM AgNO_3 solution and 4.2 mL of HCl (12.1 M). (d-f) Additional TEM images of gold NRs synthesized with 0.8 mL of seed solution, 30 mL of 4 mM AgNO_3 solution and 4.2 mL of HCl (12.1 M).

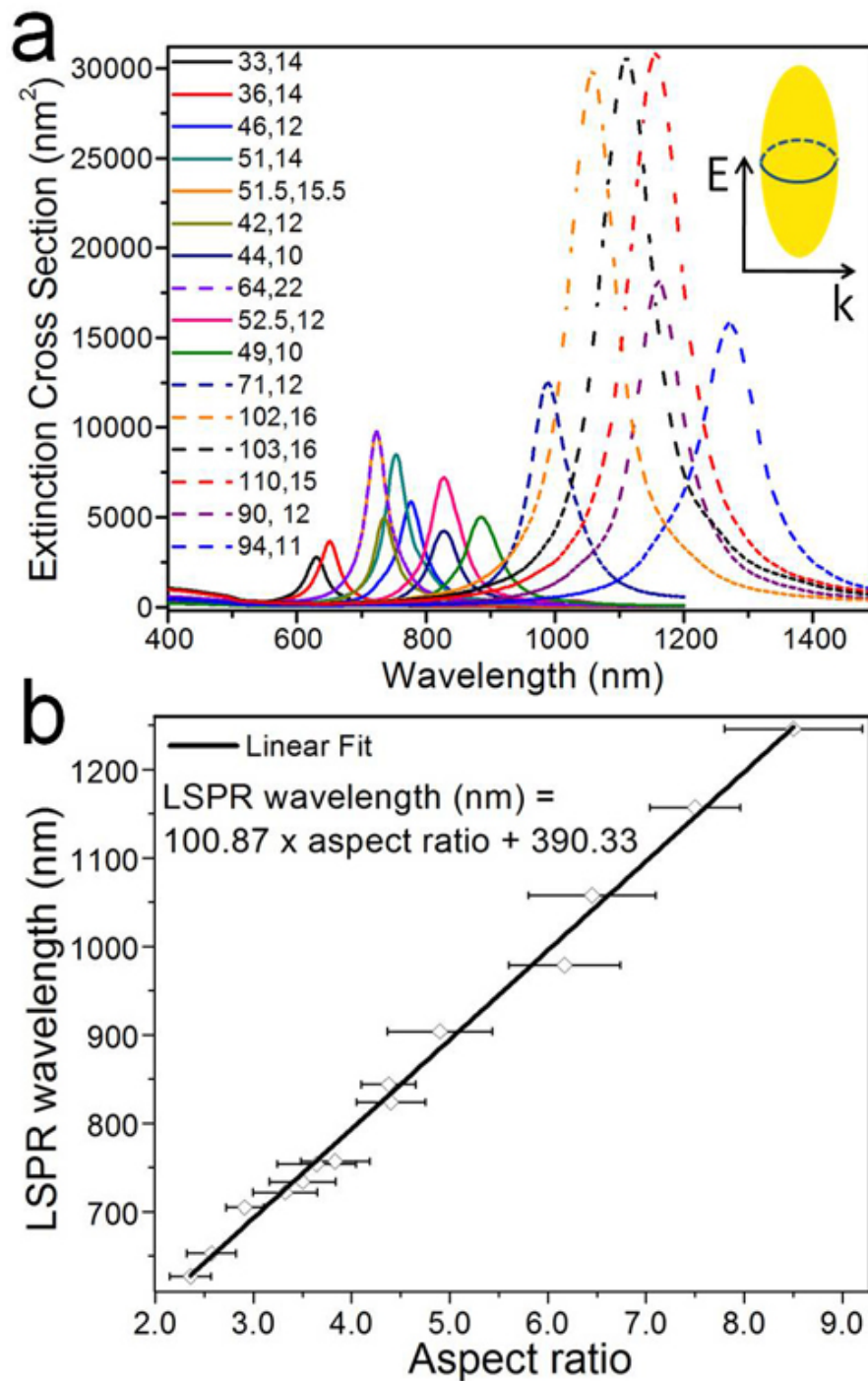


Figure S27. (a) Calculated LSPR extinction cross sections of gold NRs of various dimensions (length, width in nm given in the inset) presented in this work. (b) Dependence of LSPR wavelength on the aspect ratio of gold NR. The solid line represents a linear fit to the experimentally determined NR aspect ratios.

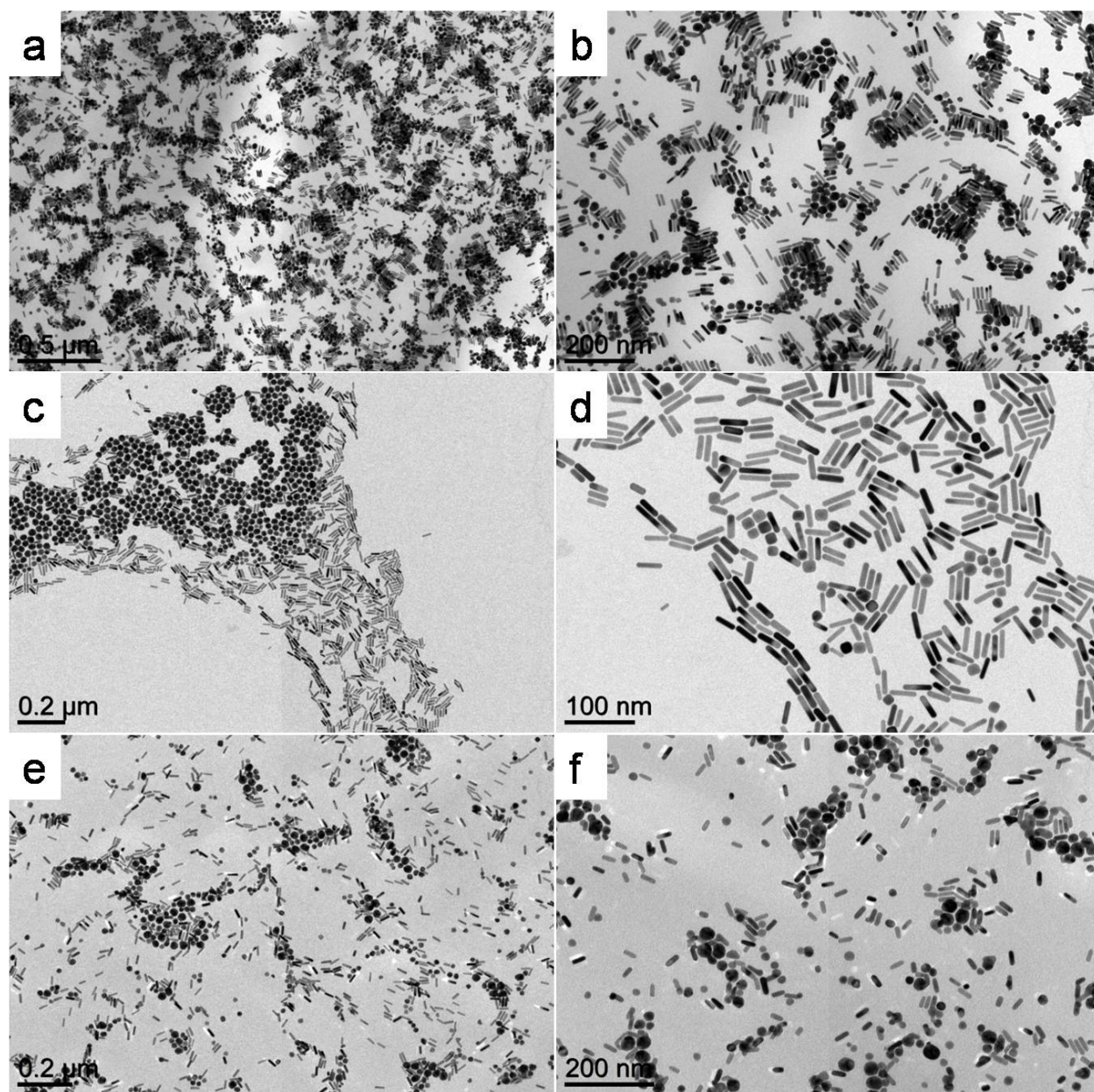


Figure S28. TEM images of three different batches of gold NRs synthesized without any aromatic additives (i.e. just 9.0 g of CTAB). (a, b) batch 1, (c, d) batch 2 and (e, f) batch 3.

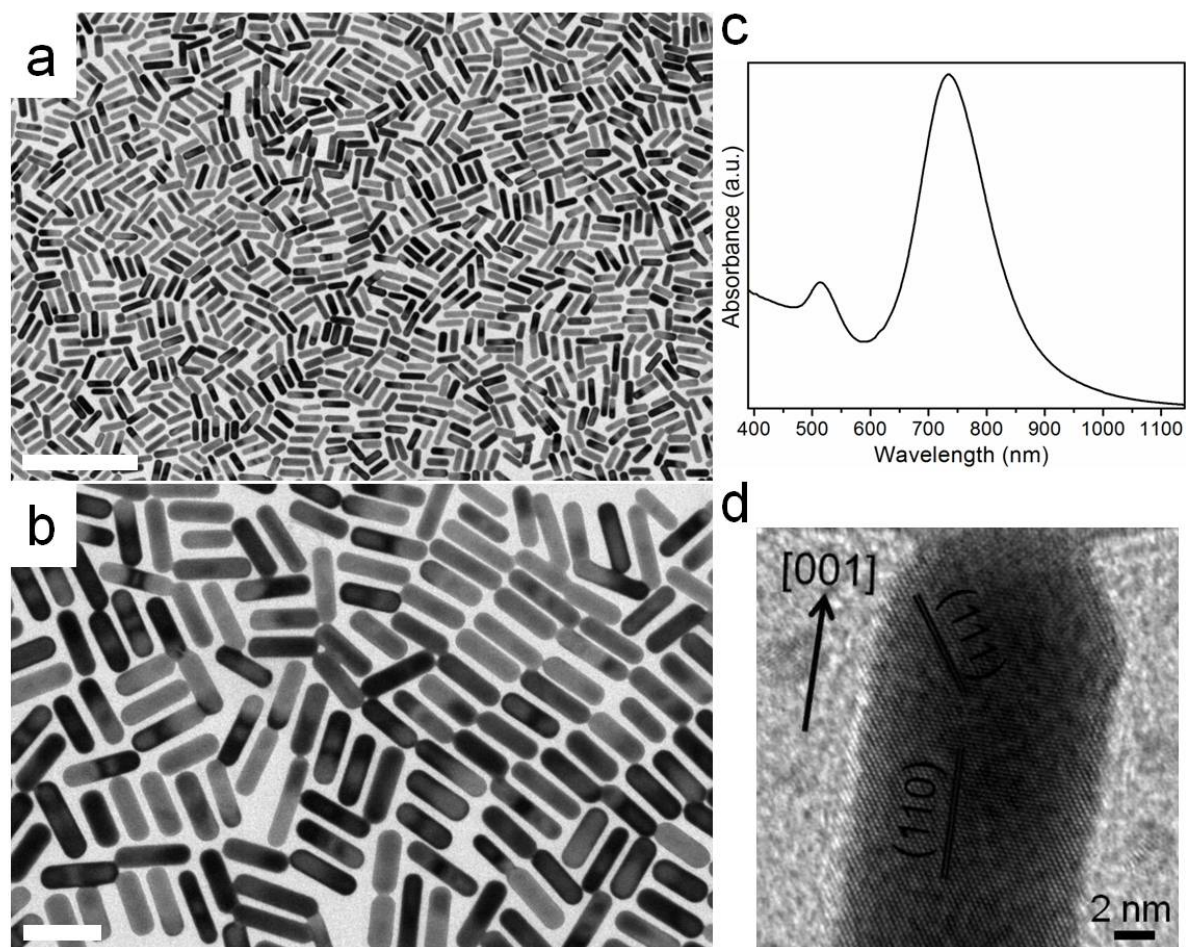


Figure S29. (a, b) TEM images, (c) UV-Vis-NIR spectrum and (d) HRTEM image of gold NRs synthesized under conditions specified in Table S1 using potassium bromide as the additive. Scale bars: a) 200 nm, b) 50 nm.

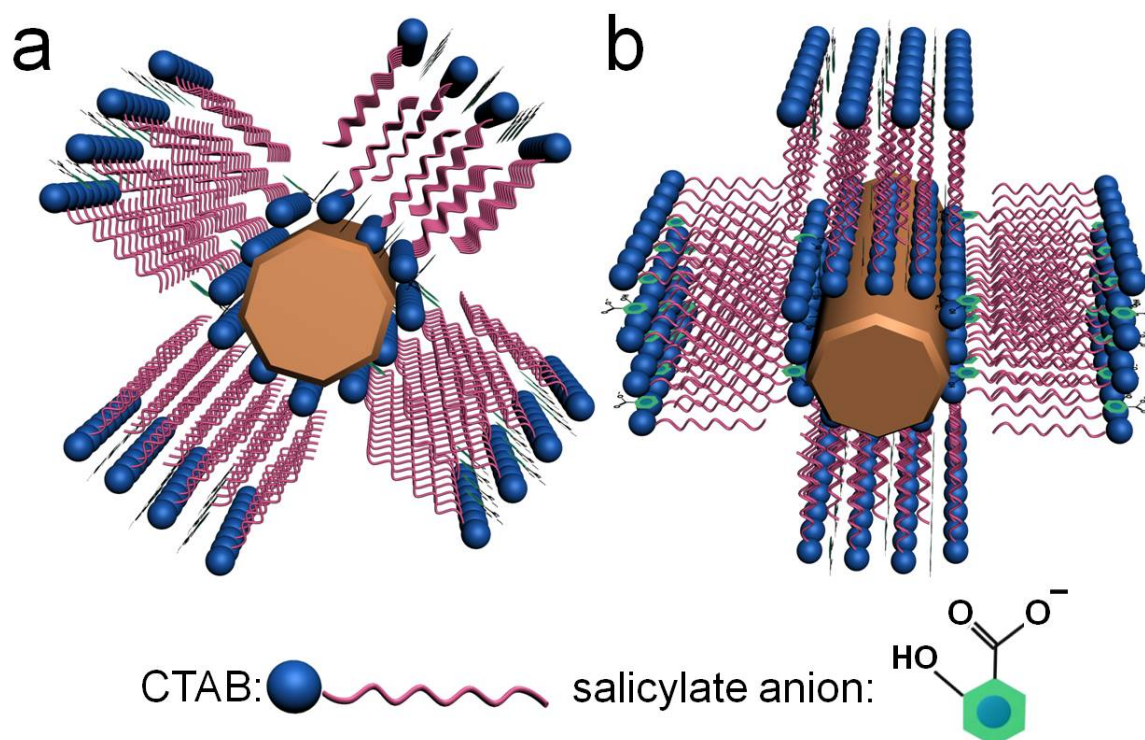


Figure S30. (a-b) Additional cartoons (oriented at different viewing angles from the one in Figure 5 in the maintext) illustrating the proposed mechanism to explain the role of aromatic additives (sodium salicylate is shown as an example) in mediating the binding between CTAB bilayers and certain facets of growing gold NRs. Note that surfactant molecules are not drawn at the nanorod tip region for clarity purpose.

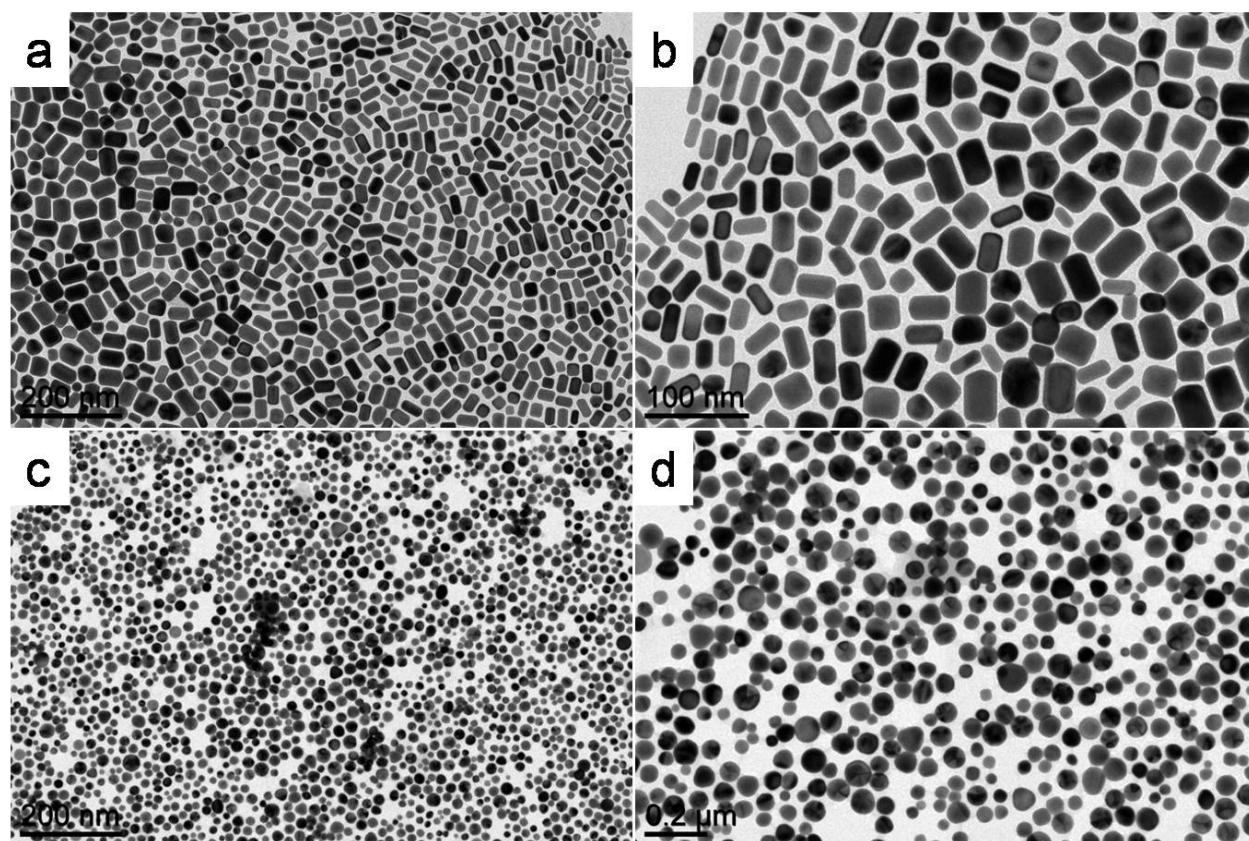


Figure S31. TEM images of gold NRs synthesized under conditions specified in Table S1 using sodium 3-methylsalicylate as the additive except with (a, b) 4.5 g of CTAB and (c, d) 1.8 g of CTAB.

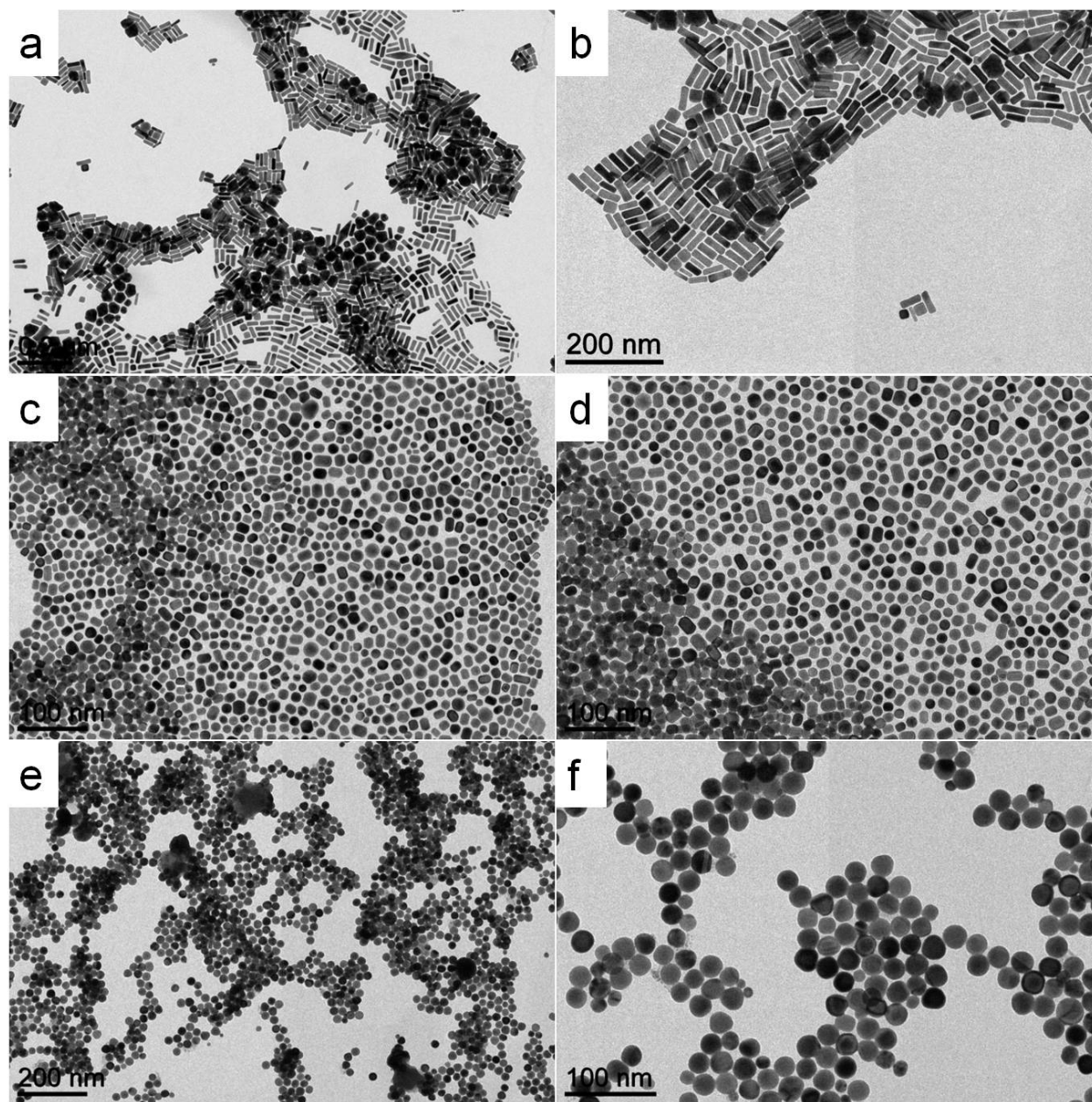


Figure S32. Variations in gold NR growth condition for the CTAB--salicylic acid system. (a, b) TEM images of gold NRs synthesized under conditions specified in Table S1 using salicylic acid as the additive except with 0.875 g of salicylic acid. (c, d) TEM images of gold nanoparticles synthesized under conditions specified in Table S1 using salicylic acid as the additive except with 3.5 g of salicylic acid and 4.5 g of CTAB. (e, f) TEM images of gold nanoparticles synthesized under conditions specified in Table S1 using salicylic acid as the additive except with 3.5 g of salicylic acid and 2.0 g of CTAB.

Table S6. Summary of results of control experiments.^a

Additive	CTAB (g)	AgNO ₃ (aq) (mL)	Ascorbic acid (aq) (mL)	Seed (mL)	Related Figure	Observation
5-Bromosalicylic acid, 1.1g	NA	NA	NA	NA	S33a, S33b	Reaction mixture is a suspension rather than a true solution due to the spare solubility of 5-bromosalicylic acid in water. Reaction proceeds slowly at about 40°C under stirring. Dark-grey colloids form after about 30h.
5-Bromosalicylic acid, 1.1g	9.0	12.0	NA	NA	NA	Reaction mixture is a true solution due to synergistic interaction between CTAB and 5-bromosalicylic acid that helps the solvation of 5-bromosalicylic acid in water. Solution stays clear after 48h, and no gold nanorods form.
5-Bromosalicylic acid, 1.1g	9.0	12.0	NA	0.8	S33c, S33d	Reaction mixture is a true solution. Solution stays clear and no gold nanorods form after 48h. Then 2.0 mL of ascorbic acid solution is added, and large irregularly-shape gold nanostructures form after another 36h.
Salicylic acid, 1.75g	NA	NA	NA	NA	S33e, S33f	Reaction mixture is a suspension rather than a true solution due to the spare solubility of salicylic acid in water. Reaction proceeds slowly at about 40°C under stirring. Dark-black colloids form after about 30h.
Salicylic acid, 1.75g	9.0	12.0	NA	NA	NA	Reaction mixture is a true solution due to synergistic interaction between CTAB and salicylic acid that helps the solvation of 5-bromosalicylic acid in water. Solution stays clear after 48h, and no gold nanorods form.
Salicylic acid, 1.75g	9.0	12.0	NA	0.8	S33g, S33h	Reaction mixture is a true solution. Solution stays clear and no gold nanorods form after 48h. Then 2.0 mL of ascorbic acid solution is added, and large irregularly-shape gold nanostructures form after another 36h.

^a The concentration of HAuCl₄ in the growth solution (500 mL) is kept at 0.5 mM for all of the above control experiments.

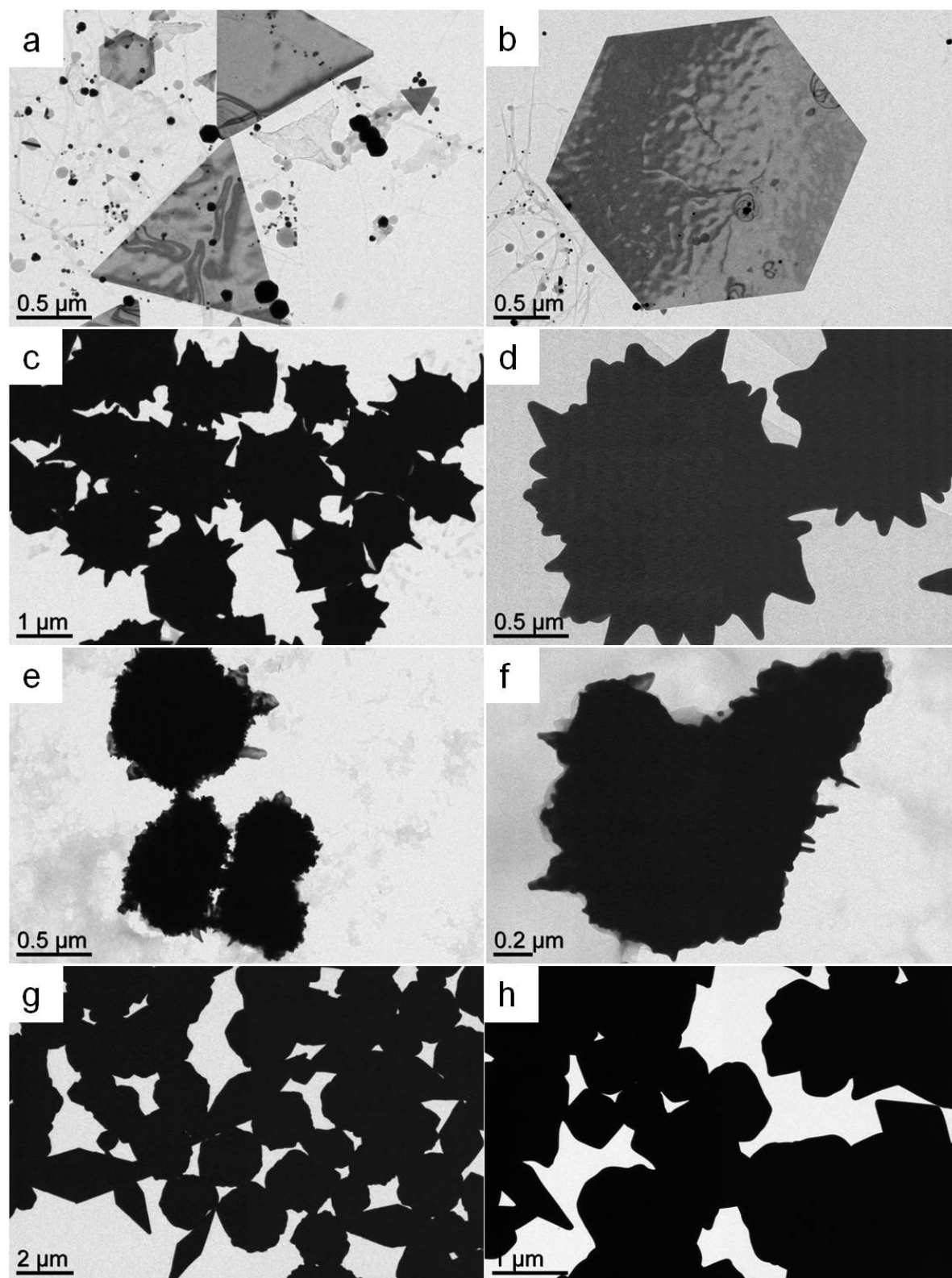


Figure S33. TEM images of gold nanostructures synthesized under reaction conditions in Table S6.

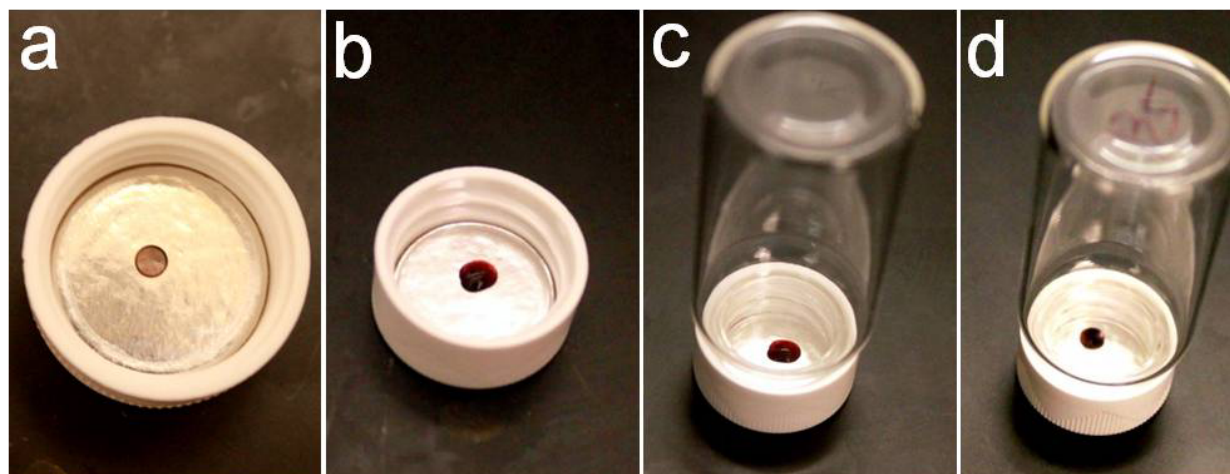


Figure S34. Illustration of the drying-mediated assembly process of gold NRs into liquid crystalline superstructures. (a) substrate preparation, (b) drop-casting of gold NR solution, (c) sealing the vial and (d) slow drying.

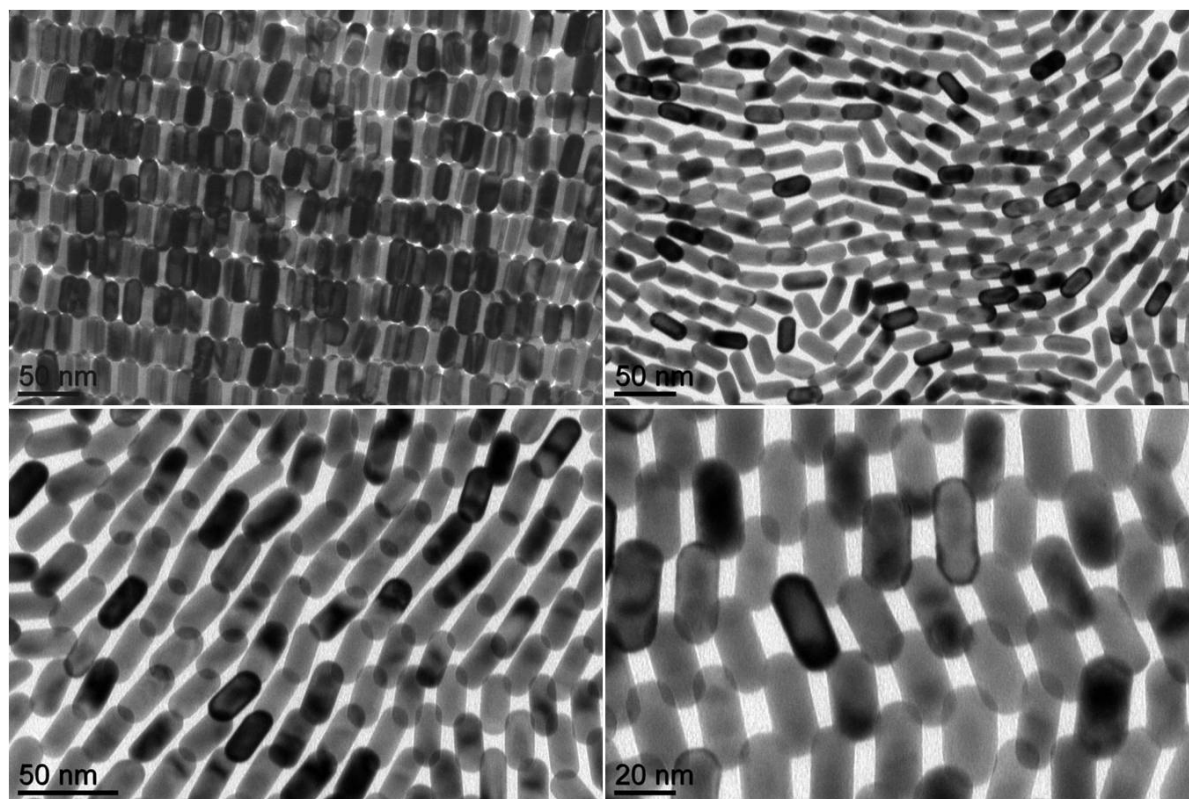


Figure S35. TEM images of liquid crystalline gold NR (aspect ratio = 2.4) assemblies. The NRs were synthesized under conditions specified in Table S1 using sodium 3-methylsalicylate as the additive.

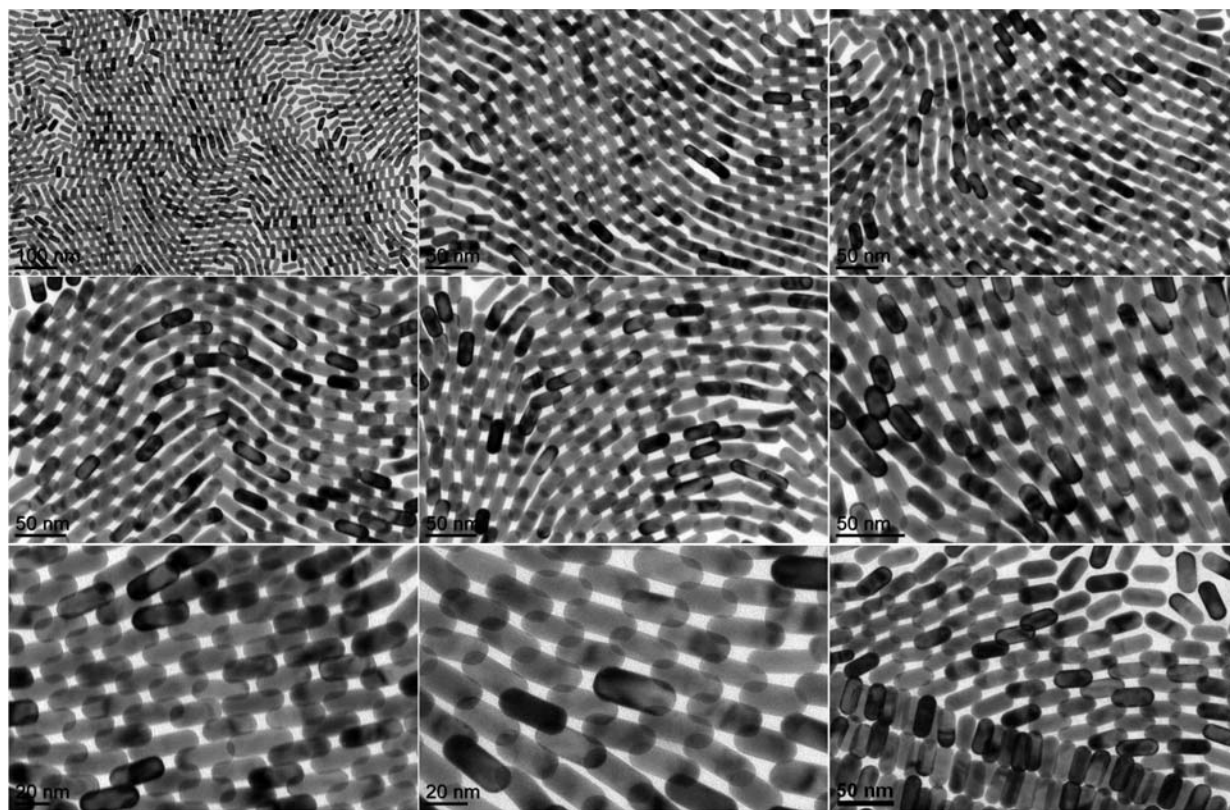


Figure S36. TEM images of liquid crystalline gold NR (aspect ratio = 2.6) assemblies. The NRs were synthesized under conditions specified in Table S1 using sodium salicylate as the additive.

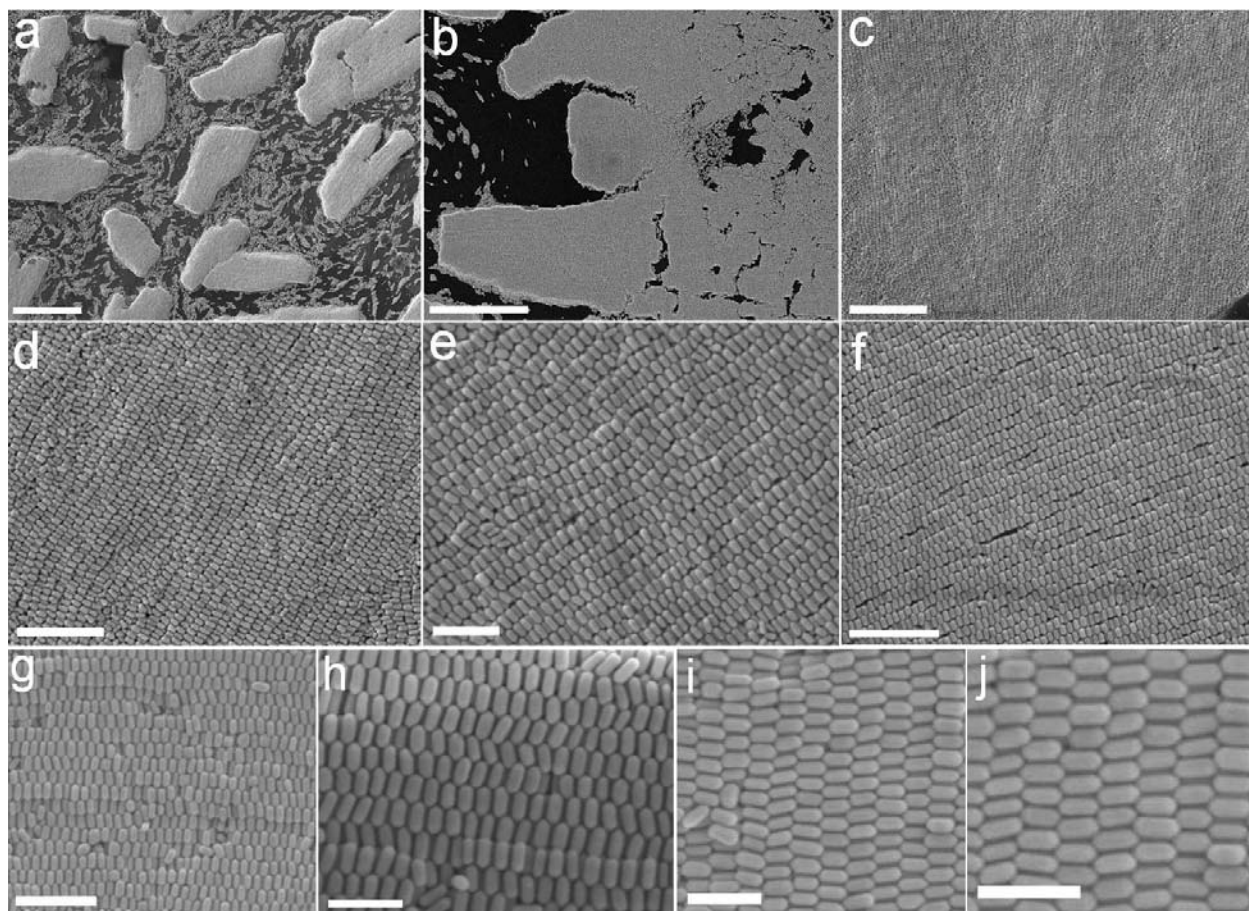


Figure S37. Additional SEM images of liquid crystalline gold NR (aspect ratio = 2.6) assemblies. The NRs were synthesized under conditions specified in Table S1 using sodium salicylate as the additive. Scale bars: a) 2 μm , b) 2 μm , c) 1 μm , d) 400 nm, e) 200 nm, f) 400 nm, g) 200 nm, h) 100 nm, i) 100 nm, j) 100 nm.

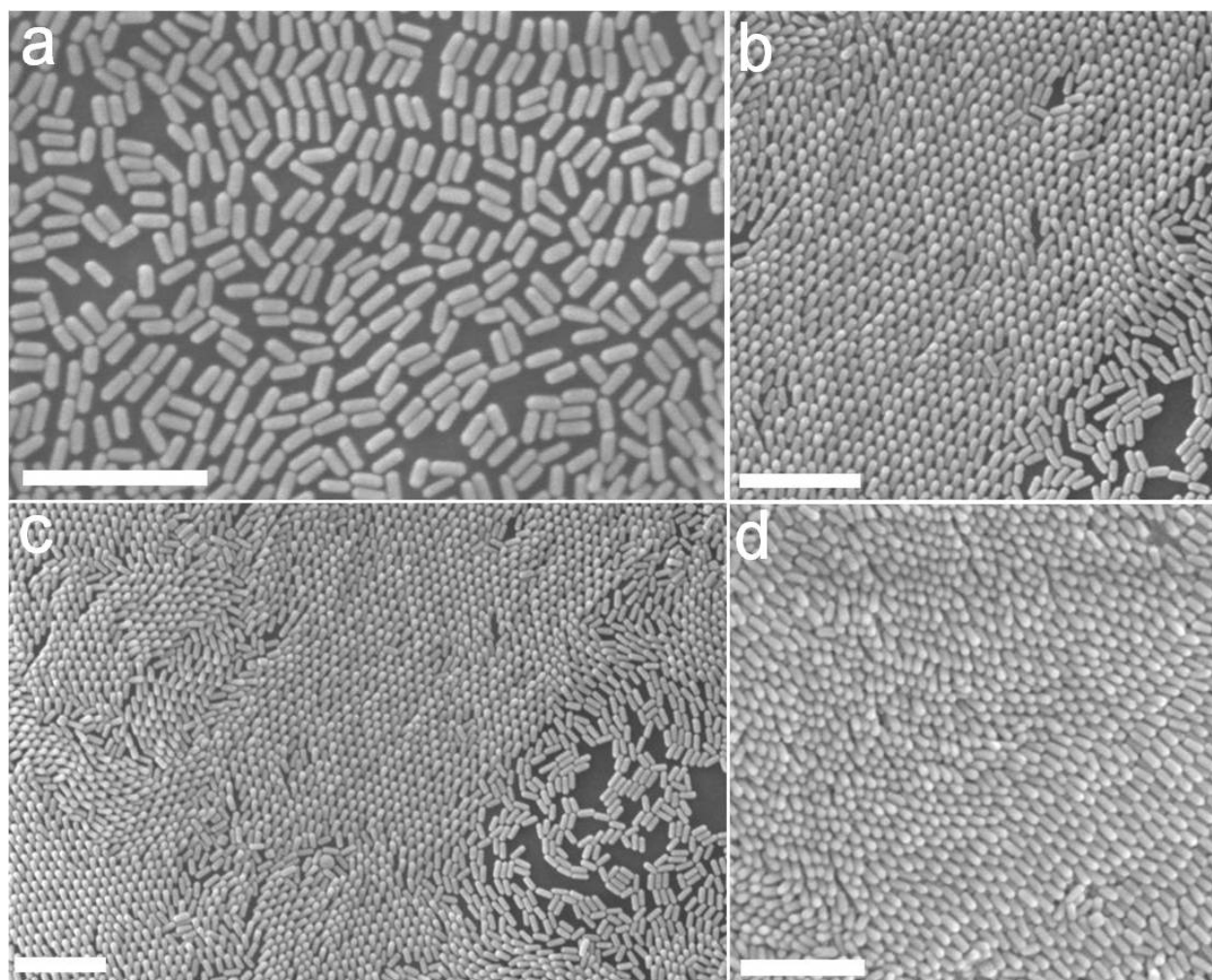


Figure S38. SEM images of (a) monolayered and (b-d) vertically aligned gold NR (aspect ratio = 2.6) assemblies. The NRs were synthesized under conditions specified in Table S1 using sodium salicylate as the additive. All scale bars represent 200 nm.

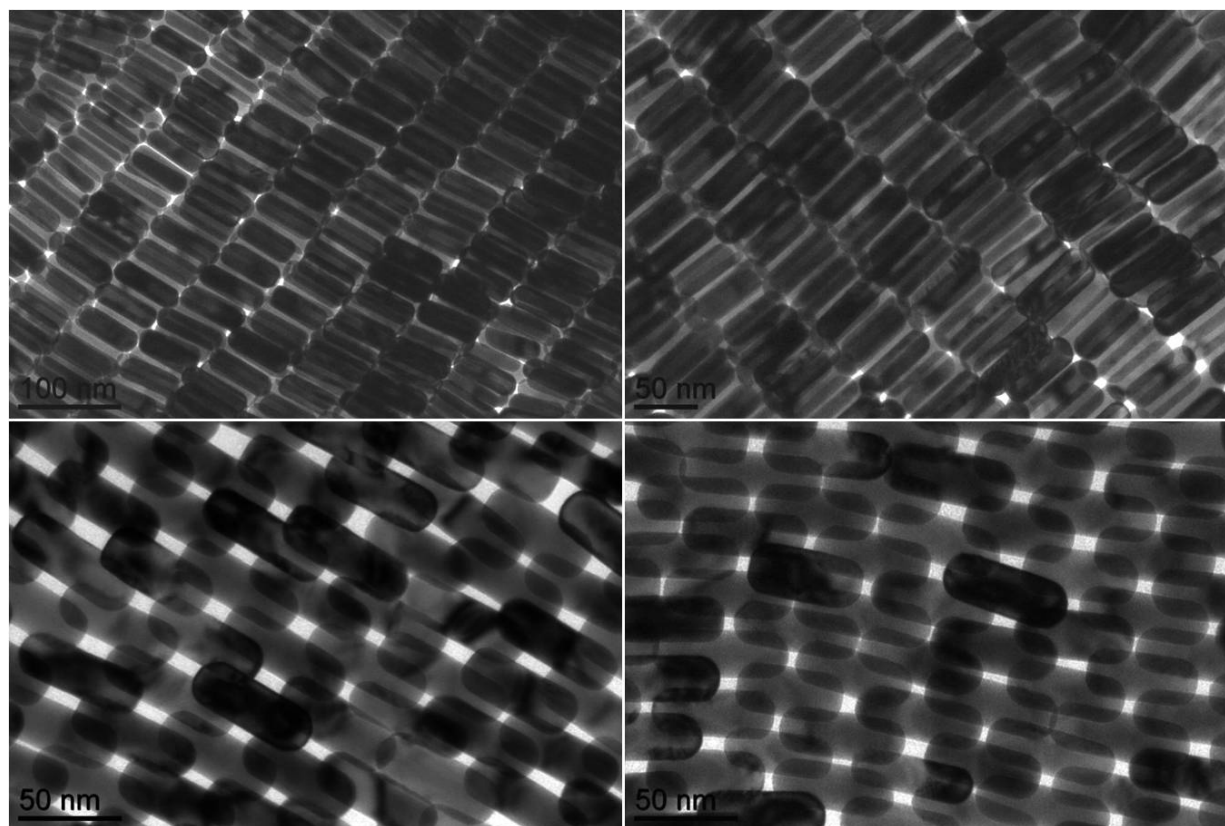


Figure S39. TEM images of liquid crystalline gold NR (aspect ratio = 2.9) assemblies. The NRs were synthesized under conditions specified in Table S1 using 5-bromosalicylic acid as the additive except with 0.2 mL of seed solution.

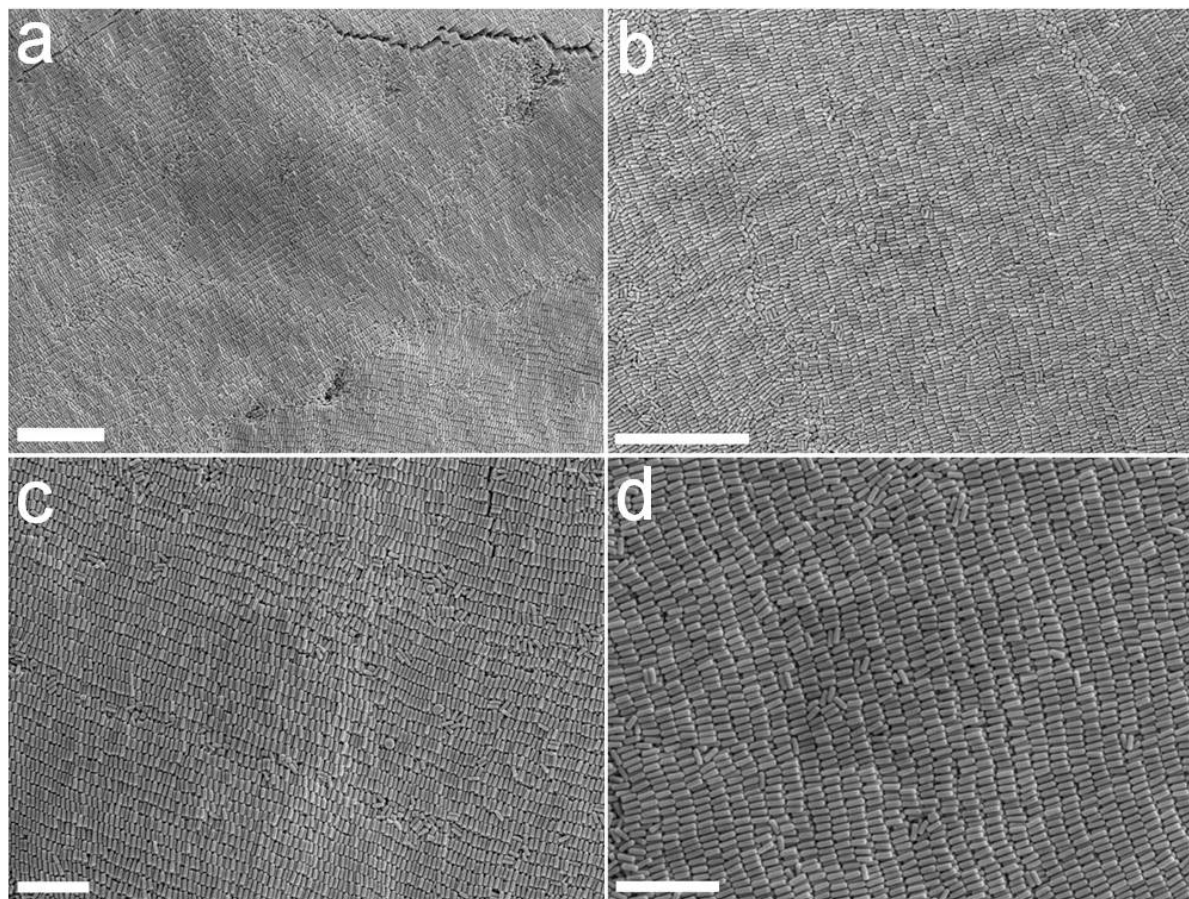


Figure S40. Additional low-magnification SEM images of liquid crystalline gold NR (aspect ratio = 2.9) assemblies. The NRs were synthesized under conditions specified in Table S1 using 5-bromosalicylic acid as the additive except with 0.2 mL of seed solution. Scale bars: (a, b) 1 μm , (c, d) 400 nm.

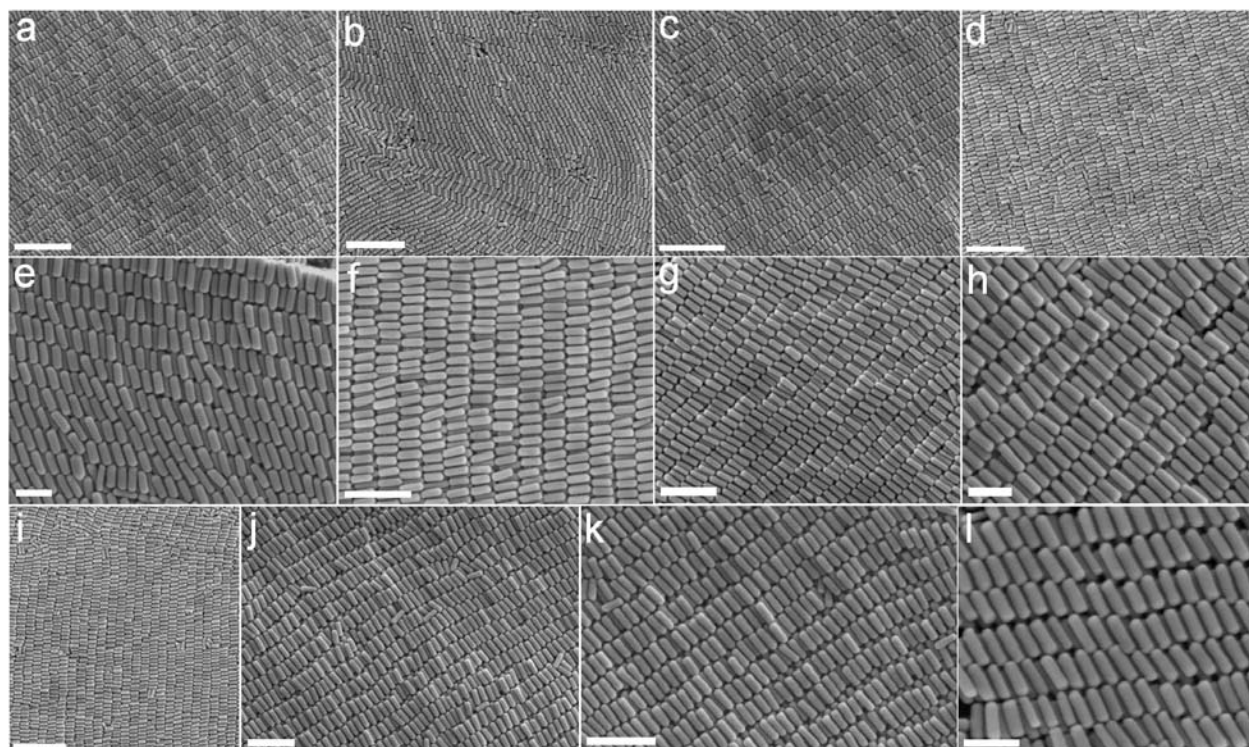


Figure S41. Additional high-magnification SEM images of liquid crystalline gold NR (aspect ratio = 2.9) assemblies. The NRs were synthesized under conditions specified in Table S1 using 5-bromosalicylic acid as the additive except with 0.2 mL of seed solution. Scale bars: a) 400 nm, b) 400 nm, c) 400 nm, d) 400 nm, e) 100 nm, f) 200 nm, g) 200 nm, h) 100 nm, i) 400 nm, j) 200 nm, k) 200 nm, l) 100 nm.

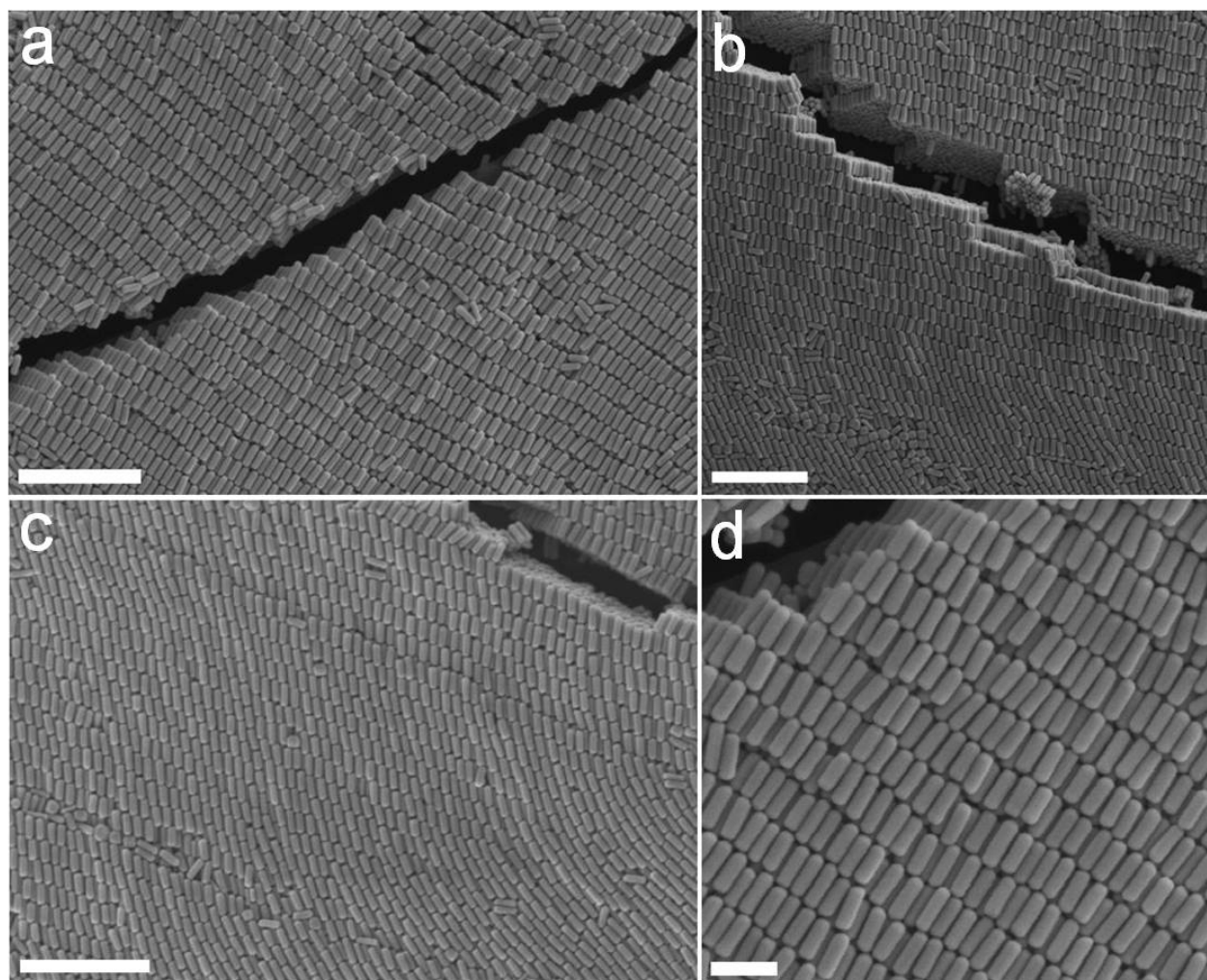


Figure S42. Additional high-magnification SEM images from those cracked regions of the liquid crystalline gold NR (aspect ratio = 2.9) assemblies. The NRs were synthesized under conditions specified in Table S1 using 5-bromosalicylic acid as the additive except with 0.2 mL of seed solution. Scale bars: a) 400 nm, b) 400 nm, c) 400 nm, d) 100 nm.

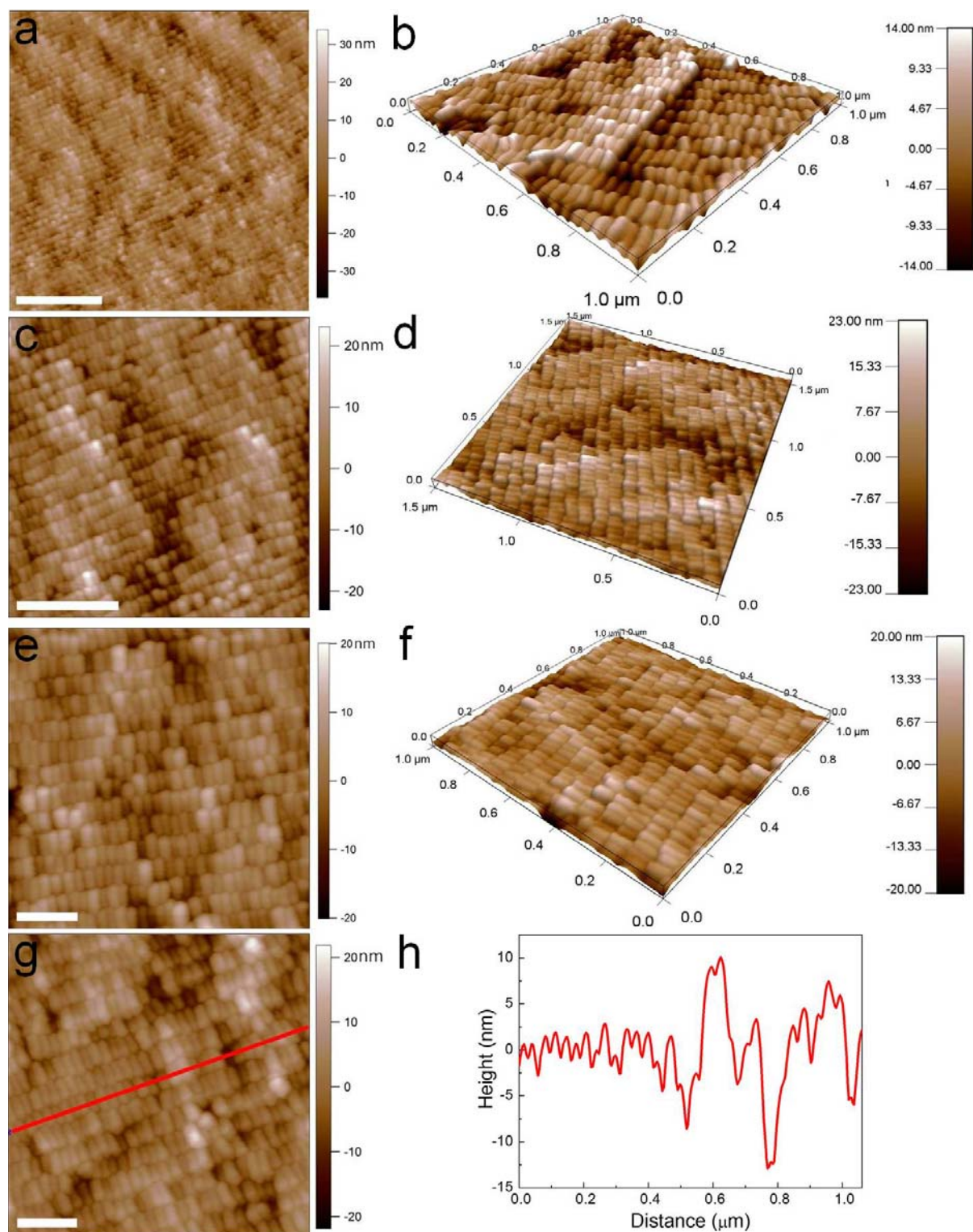


Figure S43. Additional AFM height images (a, c, e, g) and three-dimensional topography images (b, d, f) of gold NRs (aspect ratio=2.9) liquid crystalline assemblies. The scan sizes are (b) 1 μm x 1 μm , (d) 1.5 μm x 1.5 μm , and (f) 1 μm x 1 μm , respectively. (h) Height analysis of the line profile indicated in (g). Scale bars: a) 1 μm , b) 500 nm, c) 200 nm, d) 200 nm.

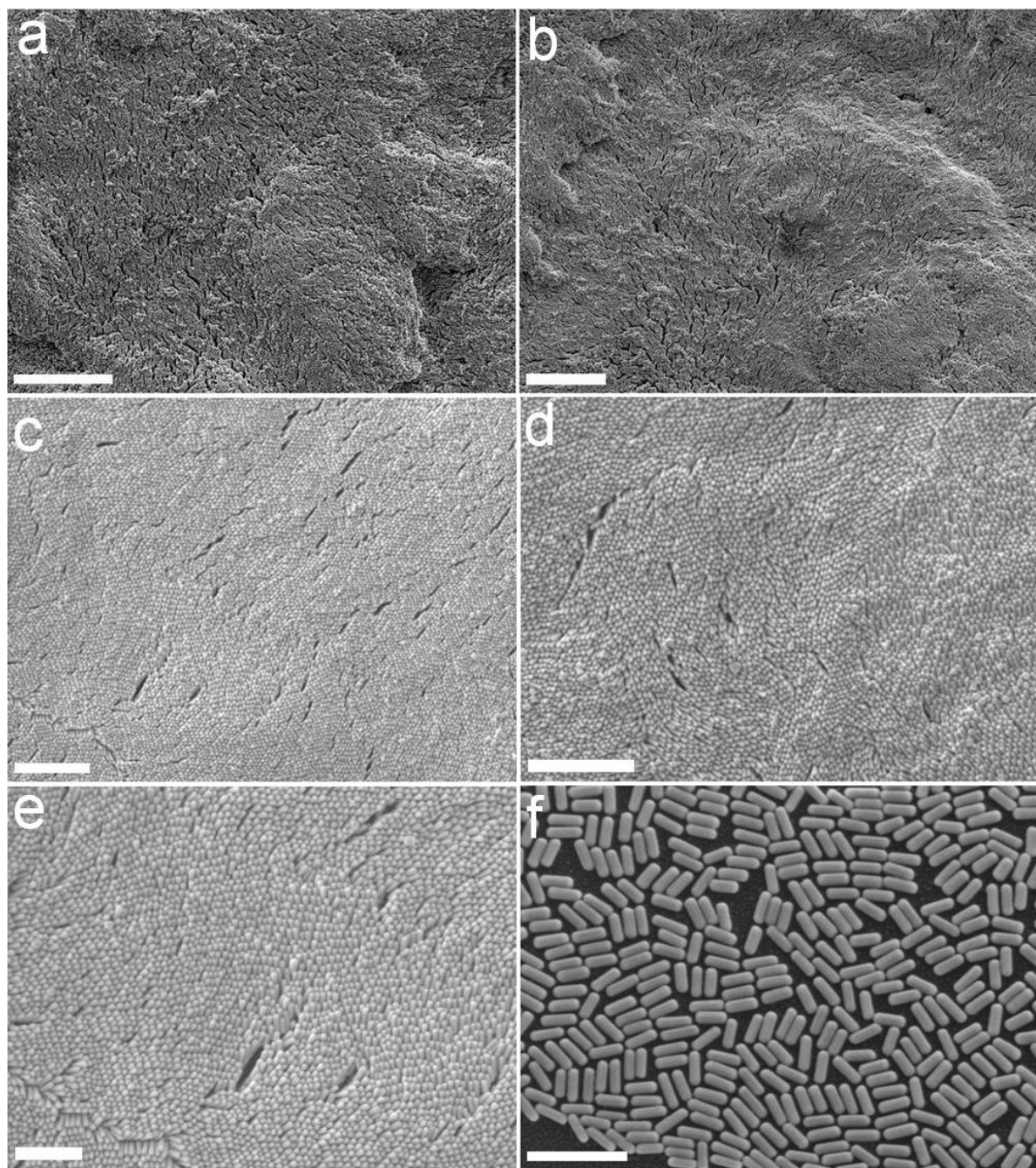


Figure S44. SEM images of (a-e) vertically aligned liquid crystalline gold NR assemblies and (f) isolated gold NRs (aspect ratio = 2.9). The NRs were synthesized under conditions specified in Table S1 using 5-bromosalicylic acid as the additive except with 0.2 mL of seed solution. Scale bars: a) 1 μm , b) 1 μm , c) 400 nm, d) 400 nm, e) 200 nm, f) 200 nm.

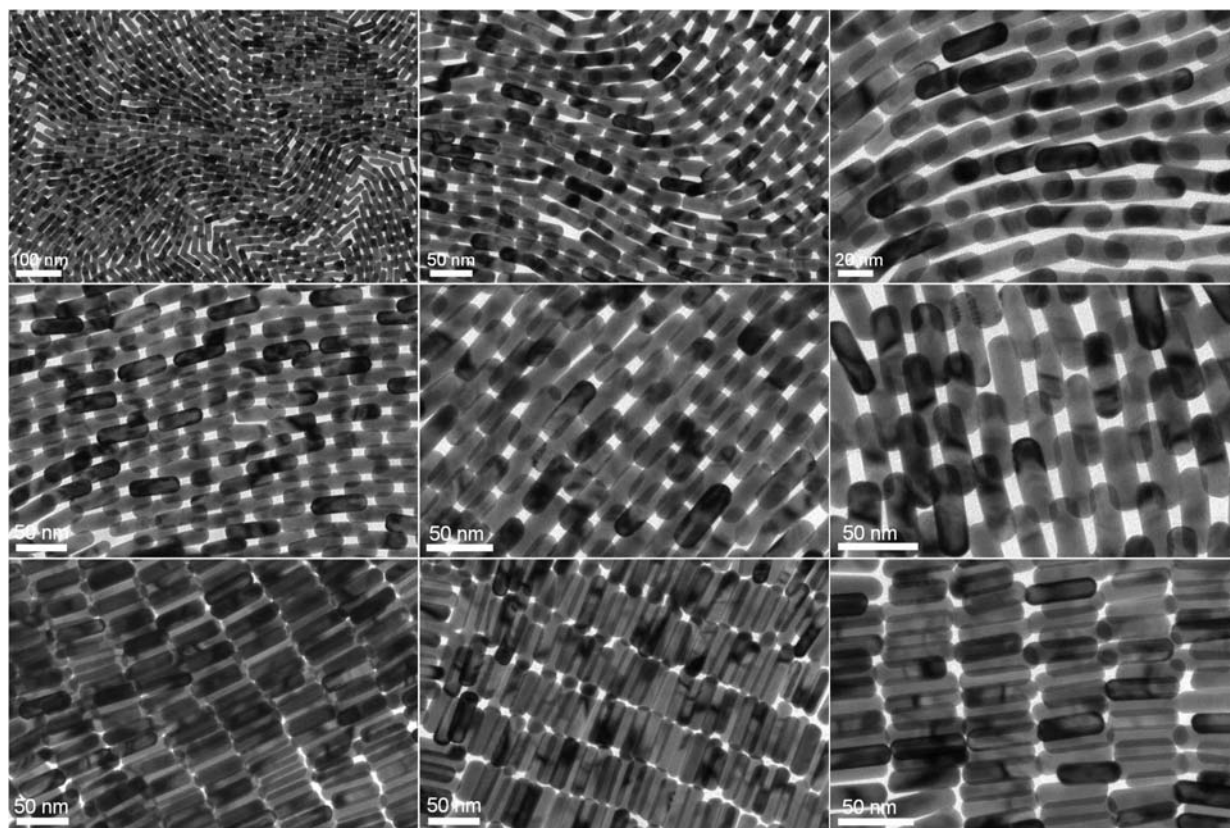


Figure S45. Additional TEM images of liquid crystalline gold NR (aspect ratio = 3.4) assemblies. The NRs were synthesized under conditions specified in Table S1 using 2,6-dihydroxybenzoic acid as the additive.

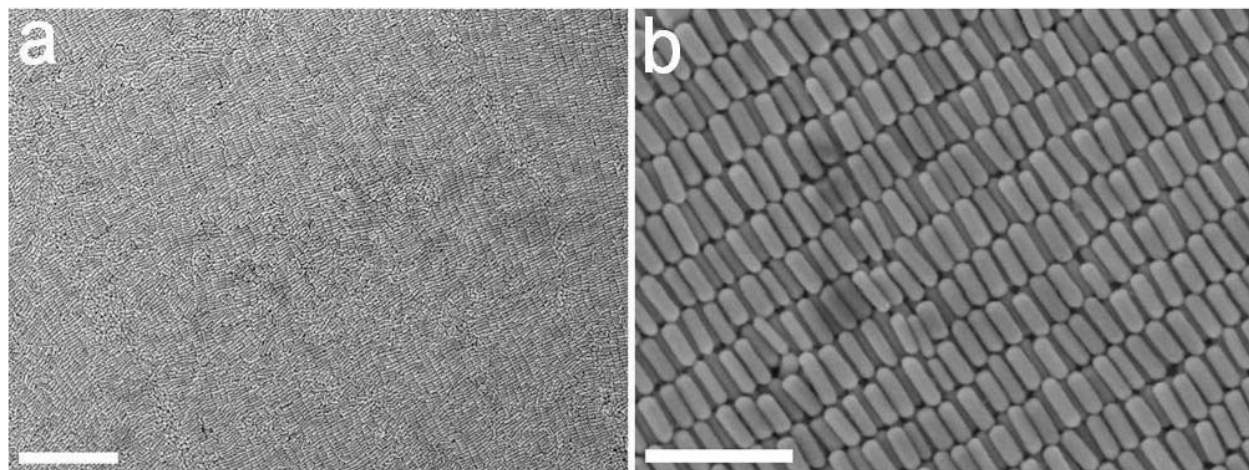


Figure S46. (a) Low- and (b) high-magnification SEM images of liquid crystalline gold NR (aspect ratio = 3.4) assemblies. The NRs were synthesized under conditions specified in Table S1 using 2,6-dihydroxybenzoic acid as the additive. Scale bars: a) 1 μm , b) 200 nm.

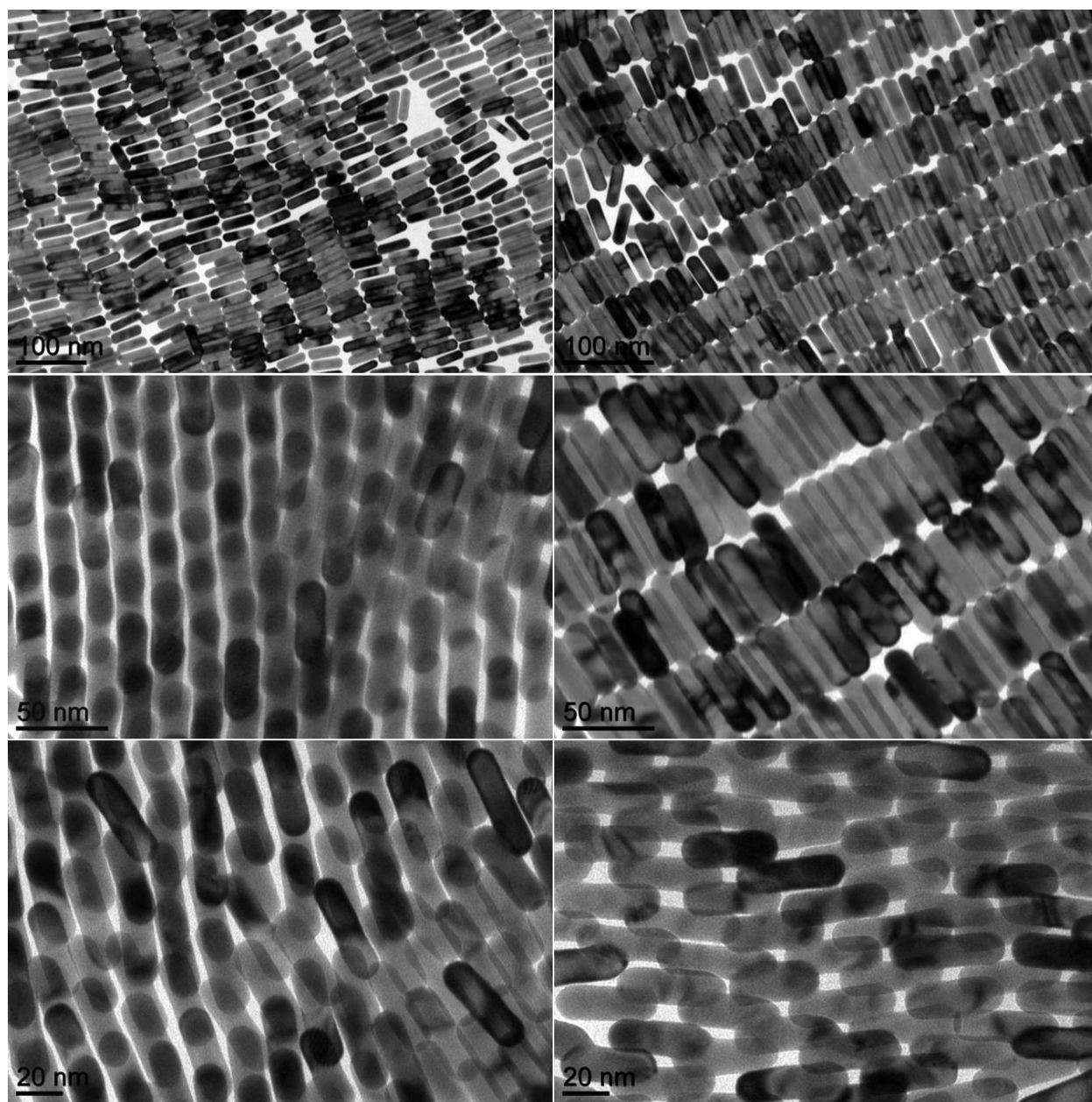


Figure S47. Additional TEM images of liquid crystalline gold NR (aspect ratio = 3.8) assemblies. The NRs were synthesized under conditions specified in Table S1 using 5-bromosalicylic acid as the additive.

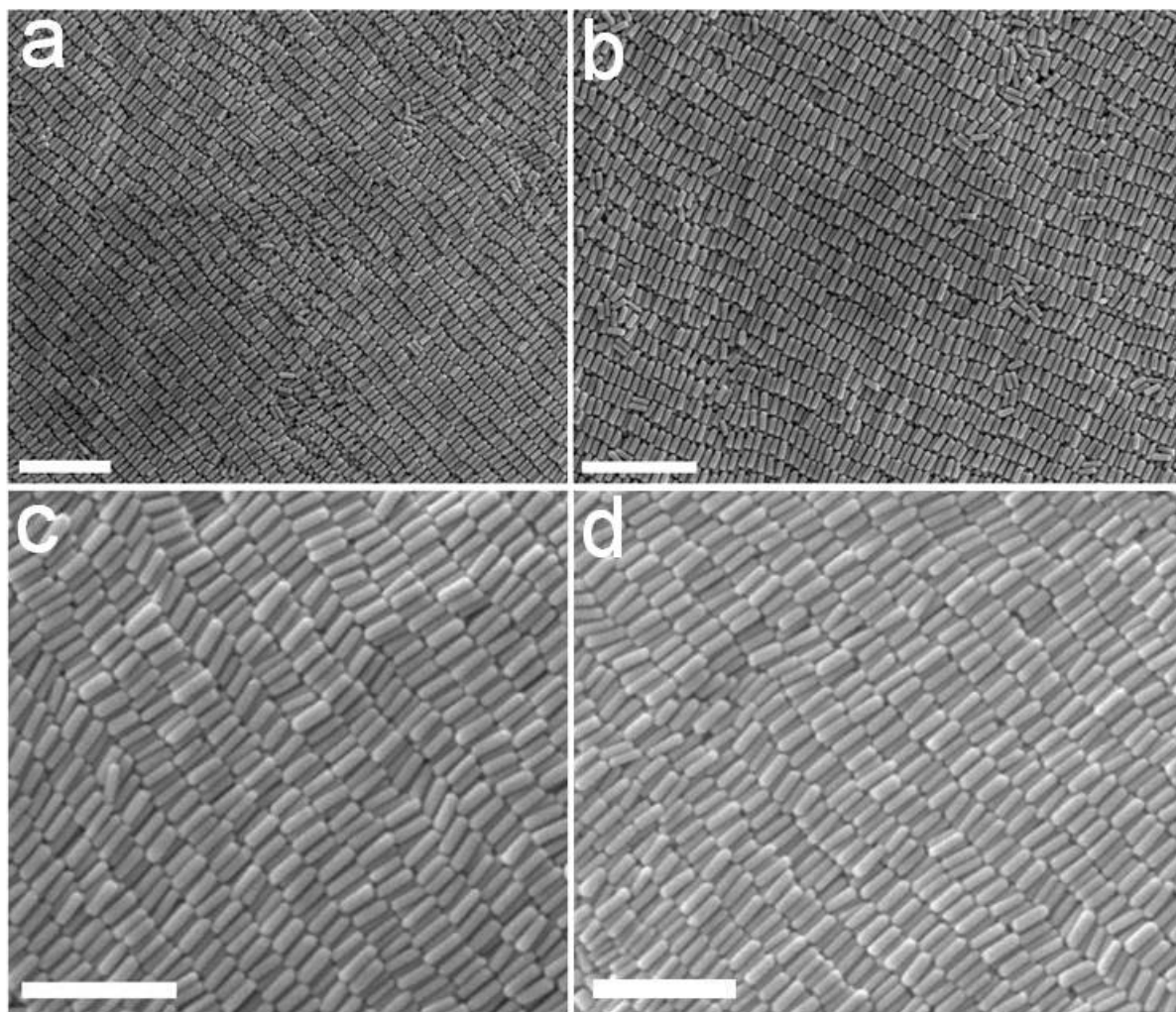


Figure S48. Additional SEM images of liquid crystalline gold NR (aspect ratio = 3.8) assemblies. The NRs were synthesized under conditions specified in Table S1 using 5-bromosalicylic acid as the additive. Scale bars: (a, b) 400 nm, (c, d) 200 nm.

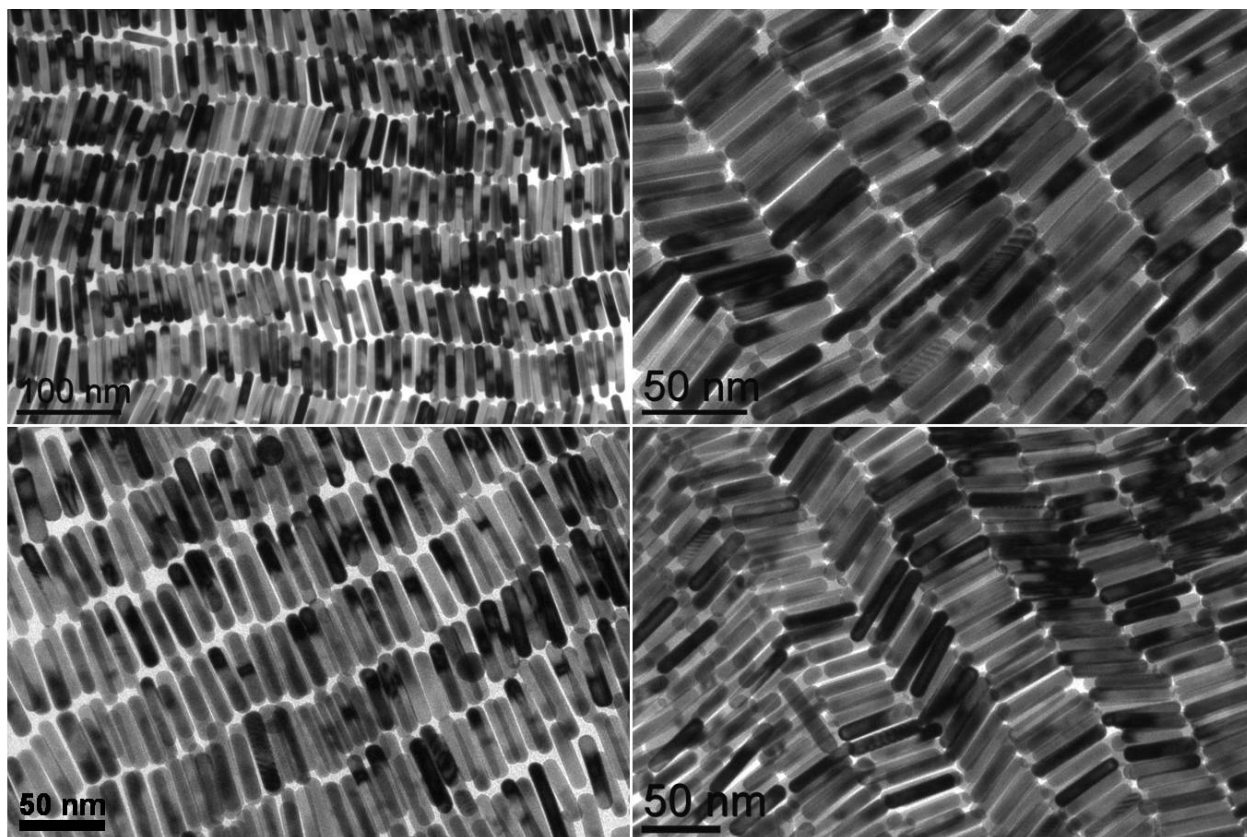


Figure S49. Additional TEM images of liquid crystalline gold NR (aspect ratio = 4.7) assemblies. The NRs were synthesized under conditions specified in Table S1 using 5-bromosalicylic acid as the additive except with 24 mL of 4 mM AgNO_3 solution.