Supporting Information

Experimental Section

Chemical and Materials. Silver nitrate (99.998%), trisodium citrate dihydrate (99.9%), and sodium hydroxide (99.99%) were purchased from Aldrich and used as received. Bis-(*p*-sulfonatophenyl)phenylphosphine dihydrate dipotassium salt (BSPP) was purchased from Strem Chemicals, Inc. All H_2O was purified with a Barnstead Nanopure^{TM} water purification system (resistance=18.1 MΩ).

Instrumentation. UV-visible spectra were recorded on a Cary-5000 UV/vis spectrometer. Transmission electron microscopy (TEM) imaging was performed on a Hitachi H2300 and H8100 transmission electron microscope (200 kV). Scanning electron microscopy (SEM) was performed on a Hitachi S4800-II scanning electron microscope. All of the irradiation experiments were performed with a halogen lamp (Dolan-Jenner, MI-150) as the light source. An optical bandpass filter (25 mm diameter, Intor Inc.) centered at 500 ± 20, 550 ± 20, 600 ± 20, 650 ± 20, 700 ± 20, 750 ± 20 nm was employed to control the irradiation wavelength. Inductively Coupled Plasma Optical Emission Spectroscopy (ICP-OES) experiments were performed on a Varian Vista-MPS ICP-OES spectrometer.

Preparation of Silver Nanoparticle Seeds. In a typical synthesis, Nanopure^{TM} water (19 mL), $AgNO_3$ (0.4 mL, 10 mM), BSPP (0.4 mL, 10 mM), trisodium citrate (0.2 mL, 0.1 M), and sodium hydroxide (1 mL, 0.1 M) were combined in a 50 mL quartz round-bottom flask. The flask was then irradiated with a hand-held UV lamp (254 nm) for 30 min. The color of the solution turned into bright yellow, indicating the formation of the silver colloid. The silver nanoparticles were purified by centrifuging at 15,000 rpm for 60 min. The silver nanoparticles were dispersed in 20 mL water.

Preparation of Silver Nanorods. Nanopure^{TM} water (19.0 mL), $AgNO_3$ (0.60 mL, 10 mM), trisodium citrate (0.30 mL, 0.10M), 0.50 mL of Ag nanoparticles (seeds) were mixed in a 24 mL glass vial. The final volume of the reaction solution was 20.0 mL. This solution was then irradiated with a 150-W halogen lamp coupled with an optical bandpass filter. A 1 cm distance between the lamp and filter was maintained throughout the reaction. The intensity of the lamp was 0.2 W, measured by an optical power meter (Newport 1916-C) coupled with a thermopile detector (818P-010-12) with an active diameter of 12 mm. As the reaction proceeded, the color of the solution changed from clear light yellow due to the seed particles to turbid light yellow, which can be explained by the non-absorbance of the visible light, as shown in the UV/Vis/NIR spectra in D_2O (Figure S1).

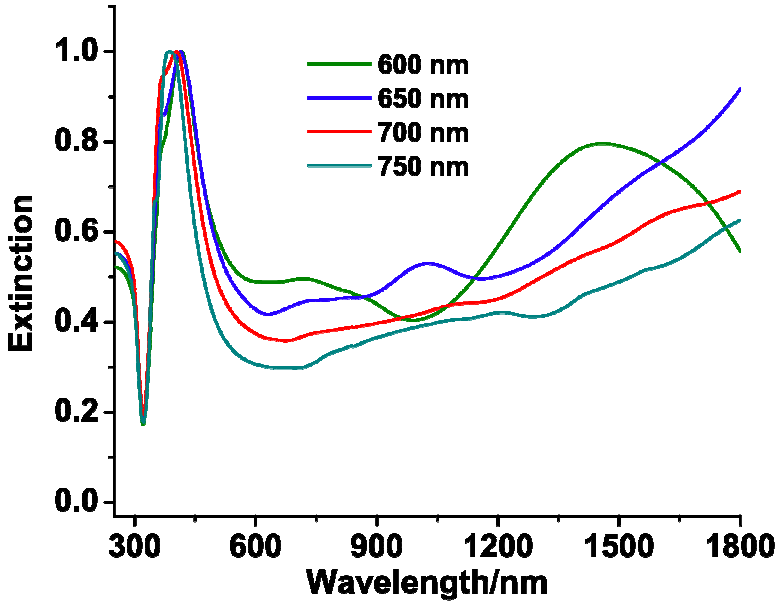

Figure S1. UV-vis-NIR spectra of the nanorods in D_2O synthesized at different wavelengths.

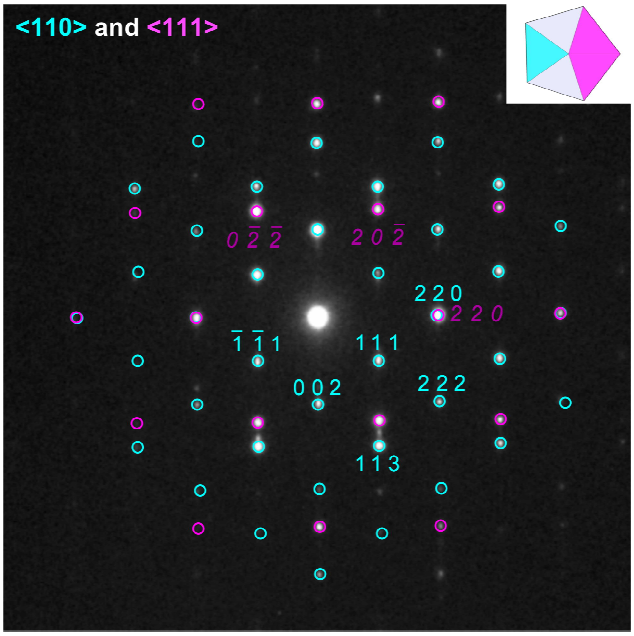

Figure S2. Selective-area electron diffraction (SAED) pattern of a single silver nanorod, showing the interpenetrating [111] (purple) and [110] (aqua) zone patterns.

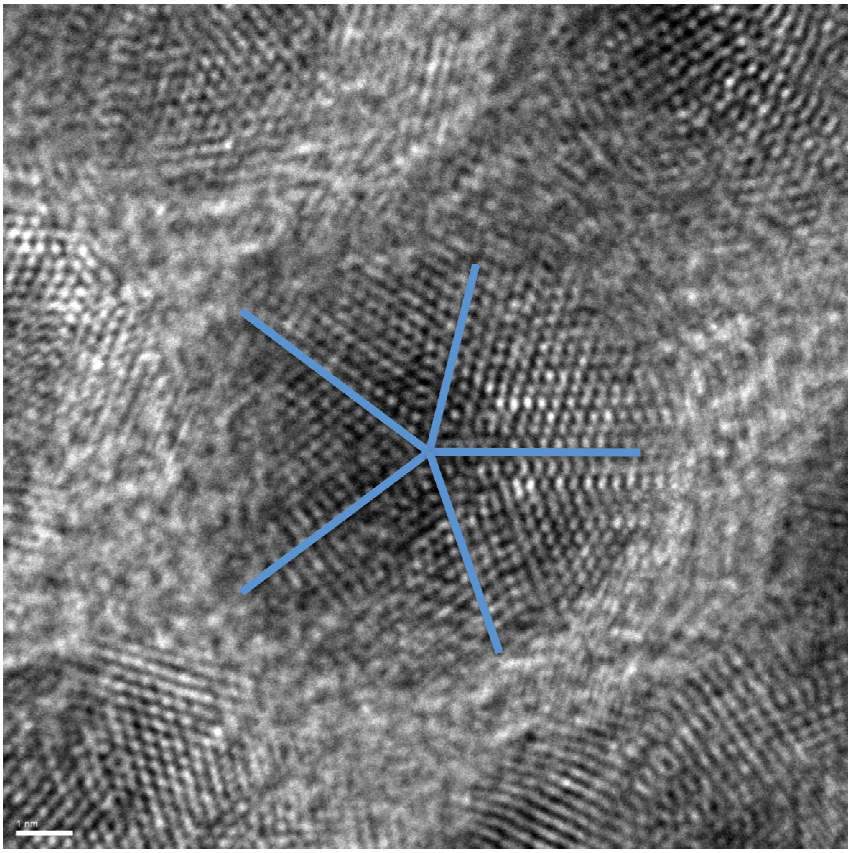

Figure S3. A high-resolution TEM image of the silver seed particles, showing the penta-twinned structure.

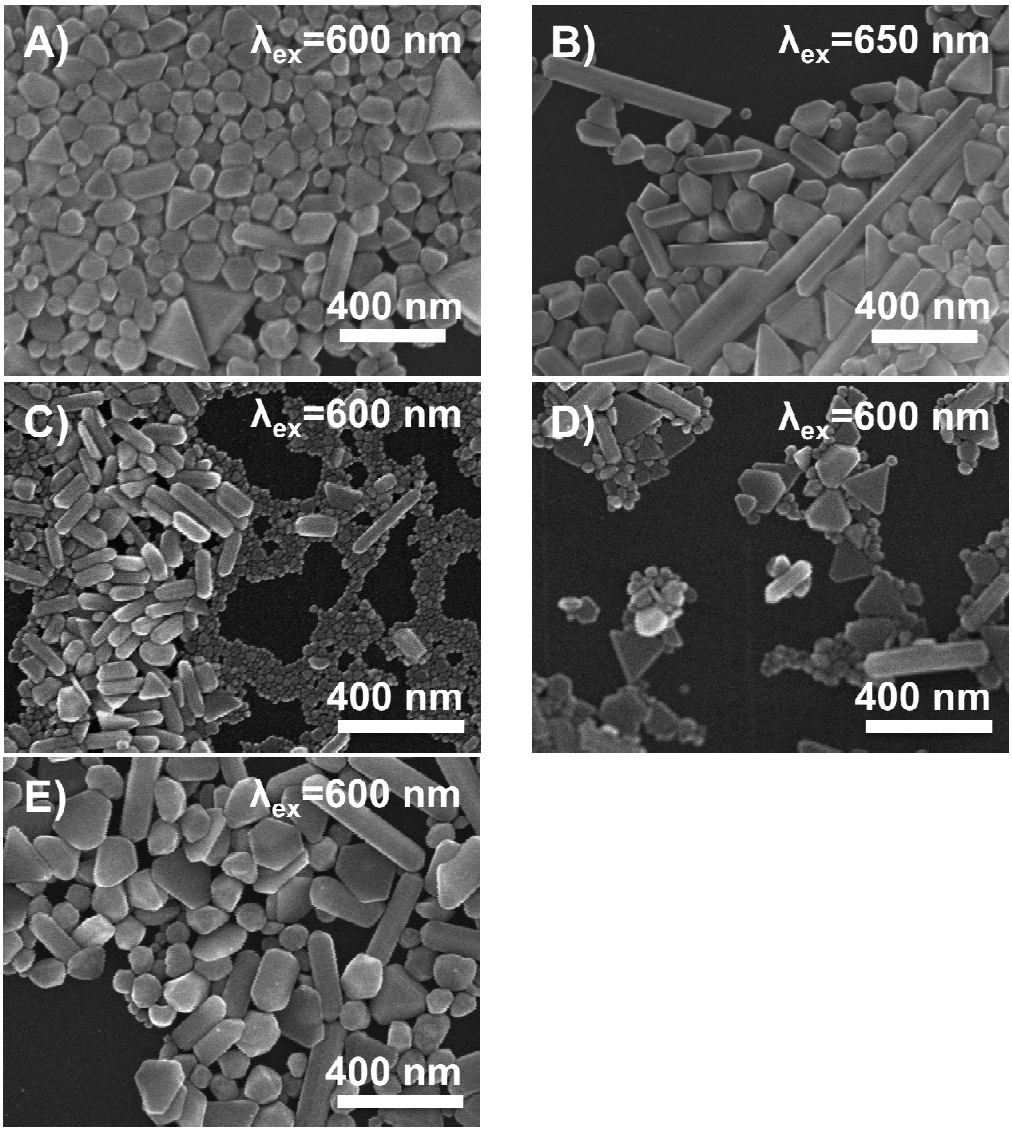

Figure S4. SEM images of the nanoparticles (scale bar 400 nm) generated at different seeding conditions: A-B). no seeds; C). Silver seeds synthesized via reduction of $NaBH_4$; D). Silver seeds synthesized via a polyol methods; E). Silver seeds purchased from Ted Pella.

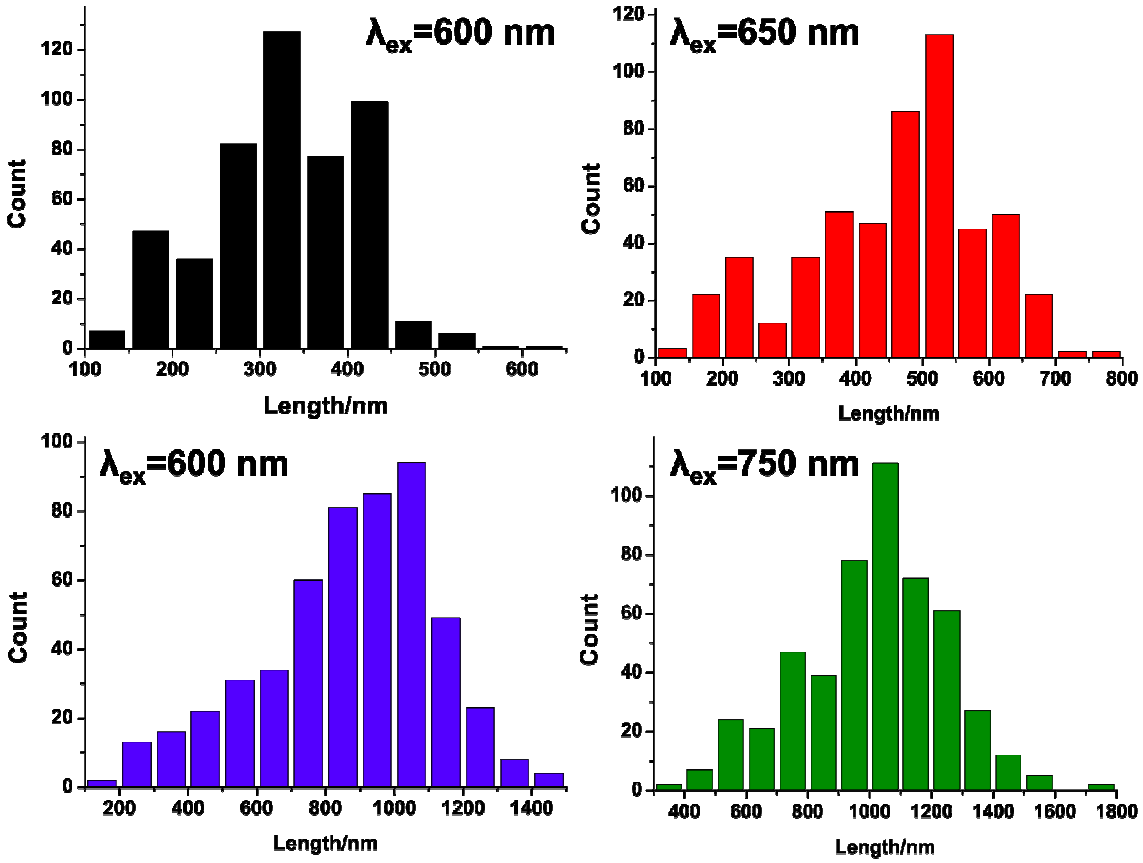

Figure S5. Statistical analysis of the length of the nanorods obtained through irradiating at 600±20, 650±20, 700±20, and 750±20 nm.