

# Phototriggered growth of crystalline Au structures in the presence of DNA- surfactant complex

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## Supplementary Information

### Experimental Details

#### *Chemicals*

Deoxyribonucleic acid (DNA) from salmon testes (D1626), hydrogen tetrachloroaurate (III) trihydrate ( $\text{HAuCl}_4 \cdot 3\text{H}_2\text{O}$ ), and Irgacure-2959(1-[4-(2-Hydroxyethoxy)-phenyl]-2-hydroxy-2-methyl-1-propane-1-one)(I-2959) were purchased from Sigma-Aldrich.

#### *Sample preparation*

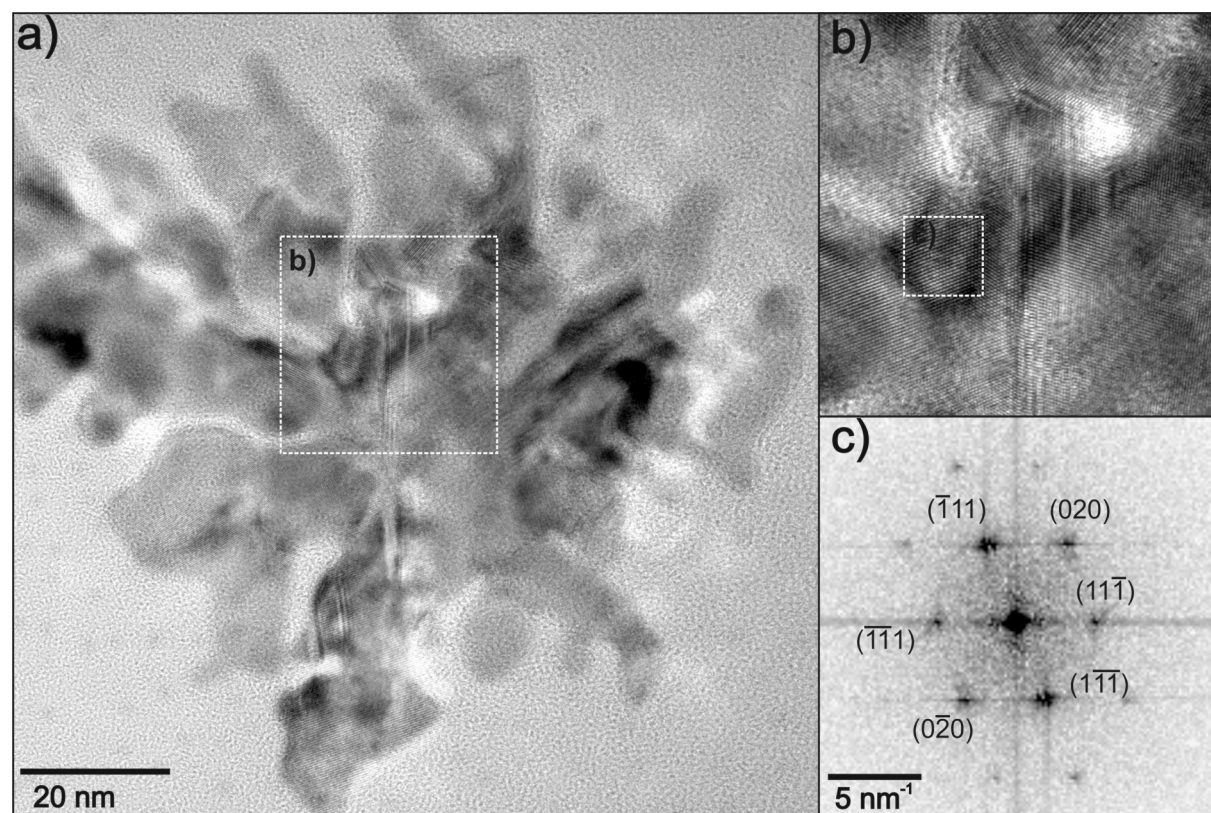
Gold nanoparticles were prepared in the solution of DNA-CTMA complex by a photochemical synthesis technique, where I-2959 was used as a reducing agent upon UV excitation and is capable of reducing  $\text{Au}^{3+}$  to  $\text{Au}^0$ , resulting in the nanoparticle formation. DNA sodium salt from salmon testes with a molecular weight of 1500kDa and CTMA (cetyltrimethylammonium chloride) were dissolved in distilled water. Both DNA and surfactant solutions were mixed together and a 1:1 stoichiometric ratio led to the spontaneous formation of hydrophobic DNA-CTMA complex that precipitated in water. The white DNA-CTMA precipitate was then collected and centrifuged to remove excess surfactant. Gold nanoparticles were synthesized by preparing solution consisting of DNA-CTMA, I-2959, and  $\text{HAuCl}_4$  in organic solvent. Typically, a 5 ml aqueous solution containing 32mM DNA-CTMA and 7 ml 4mM  $\text{HAuCl}_4$  were stirred for one hour and then 7 ml 69mM I-2959 was added. The colour of the solution turned yellow immediately, indicating the simultaneous formation of nanoparticles. The samples were then irradiated with a 6W UV lamp at 365nm to induce further growth. In the experiments where SDS is used, 5ml 32mM DNA-CTMA and 7ml 4mM  $\text{HAuCl}_4$  were stirred for one hour and then 7ml 69mM I-2959 was added. The sample was irradiated with 6W UV for 15 minutes for the growth of nanostructures. Then 13ml 5.67mM SDS was added and the sample was irradiated further (15 minutes) to form worm-like structure.

#### *Equipment and characterization*

TEM investigations were performed on a 200 kV Philips CM200FEG/ST equipped with a field emission gun and a spectrometer for energy dispersive x-ray spectroscopy (EDXS).

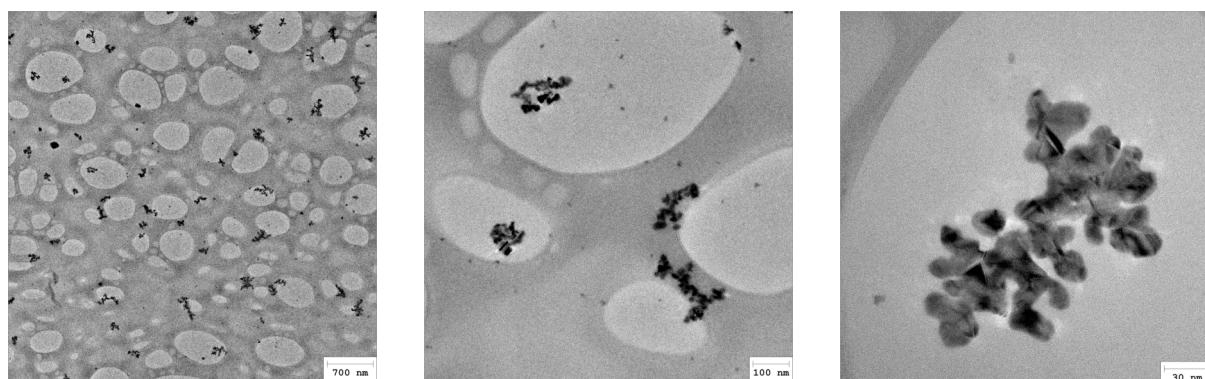
Samples for TEM were prepared on commercially available copper grids coated with a lace-like carbon layer supporting an ultrathin carbon film of 3 nm thickness (Ted Pella Inc., California, USA). The NPs solution was shaken before the application of several drops to the film. Any influence of sample preparation on size and shape of the observed NPs was avoided as much as possible by screening large sample areas. However a possible 3D structure of large NPs in solution cannot be imaged by TEM due to limited depth of focus. Bubble-like contrasts in images with low resolution stem from the lace-like structure of the carbon support or from the holes in the film. Fast Fourier Transforms (FFT) of the images were calculated using the Digital Micrograph software package (Gatan, California, USA). Simulations of the Gold structure were conducted using the JEMS software package (P. Stadelmann, Switzerland). UV-VIS absorption spectra were obtained by a PerkinElmerUV/VIS spectrometer (Lambda 35). Photoluminescence spectra were recorded by aHitachi F-7000 fluorescence spectrometer.

**Fig.S1**



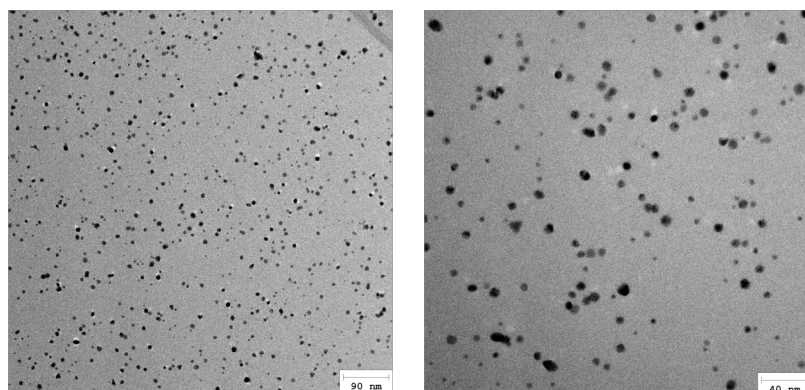
**Figure S1:** HRTEM images of an anisotropic Au crystalline structure observed after irradiation of the DNA/CTMA/HAuCl<sub>4</sub> in presence of I-2959 in 2-isopropanol (a). Area used for crystal study (b) and the diffraction pattern of Fm-3m gold structure (c).

**Fig. S2**



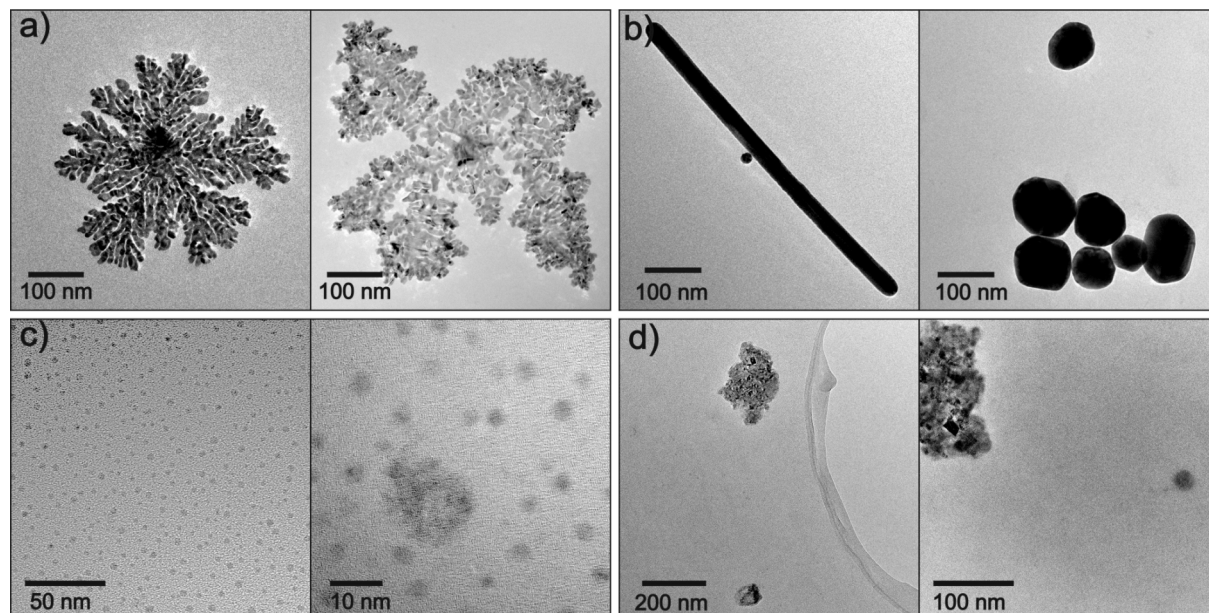
**Figure S2:** TEM images of the nanostructures formed by 15 min irradiation of DNA/CTMA/HAuCl<sub>4</sub> with 365 nm light in the absence of photosensitizer I-2959.

**Fig. S3**



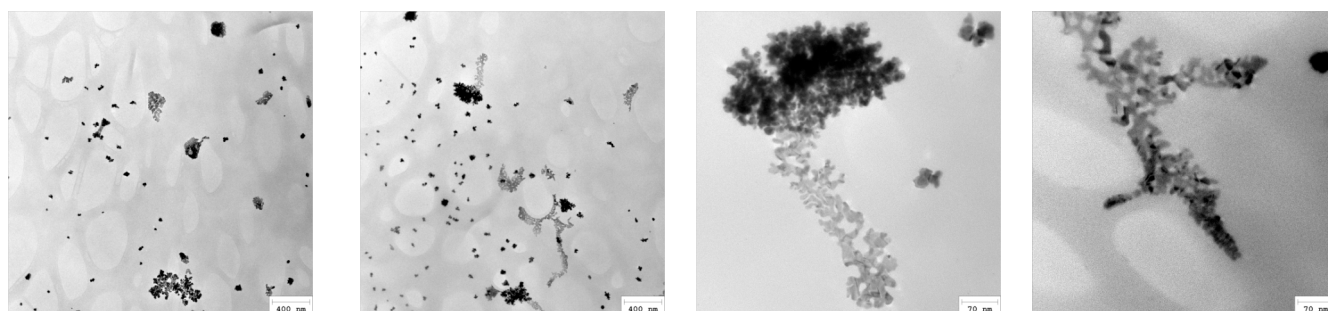
**Figure S3:** TEM images of spherical Au NP prepared by reduction of DNA/CTMA/HAuCl<sub>4</sub> with NaBH<sub>4</sub>.

**Fig. S4**



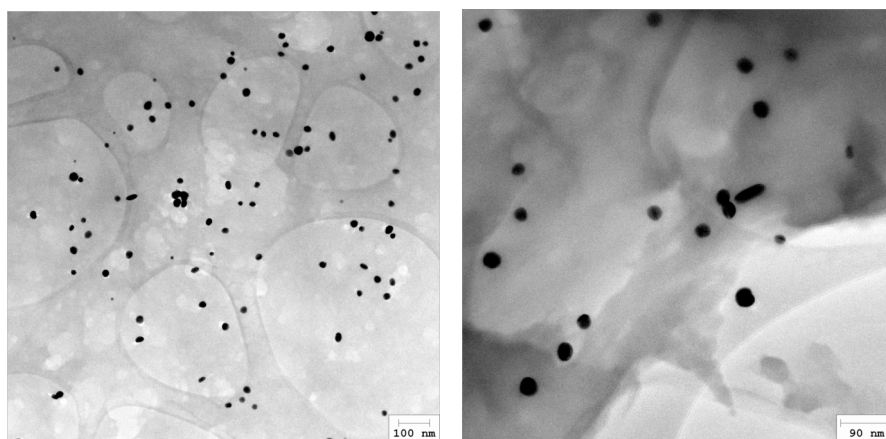
**Figure S4:** TEM images of nanostructures formed after 15 min irradiation of a) DNA/CTMA/HAuCl<sub>4</sub>, b) HAuCl<sub>4</sub> only, c) CTMA/HAuCl<sub>4</sub> and d) DNA/HAuCl<sub>4</sub> in the presence of photosensitizer I-2959.

**Fig. S5**



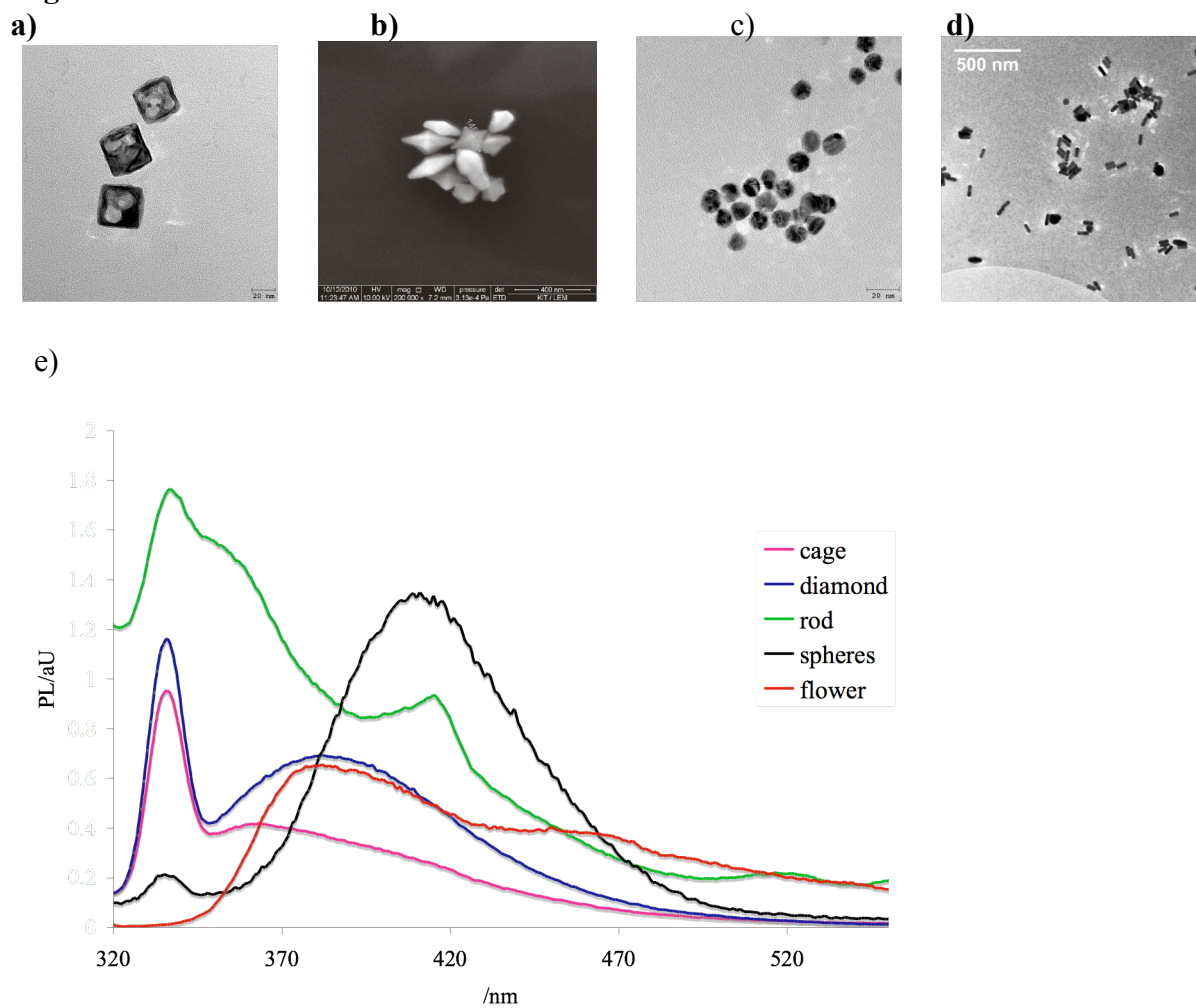
**Figure S5:** TEM images of structures obtained after the addition of SDS to DNA/CTMA/HAuCl<sub>4</sub> previously irradiated for 15 min in the presence of photosensitizer I-2959.

**Fig. S6**



**Figure S6:** NP obtained after replacement of CTMA with SDS and irradiation of DNA/SDS/HAuCl<sub>4</sub> for 15 min in the presence of I-2959.

**Fig S7**



**Figure S7:** TEM (a,c,d) and SEM(b) images of Au nanostructures used for photoluminescence studies; cages(a), diamonds (b), spheres (c) and rods (d). PL spectra of compared nanostructures (e)

