SUPPLEMENT SECTION 1

Chemical synthesis and characterization of colloidal gold nanoparticles (see references 26 and 27 for details). Briefly**,** gold nanoparticles (NPs) with sizes 14, 30, 50, 74 and 100 nm were prepared by the citrate reduction of chloroauric acid. In this method, 300 μl of 1% chloroauric acid was added to 30 ml of doubled distilled water and brought to boil. Next, 600, 300, 240, 180, and 120 ml of 1% citric acid was added to the solution to produce nanoparticles with the sizes 14, 30, 50, 74, and 100 nm, respectively. Refluxing of the solution continued until the color of the boiling solution changes from dark purple to red vine color. TEM images and dynamic light scattering experiments confirmed the size of the gold nanoparticles (see figure S1). Thes gold nanoparticles were further characterized by UV-vis spectrophotometry (see figure S2).

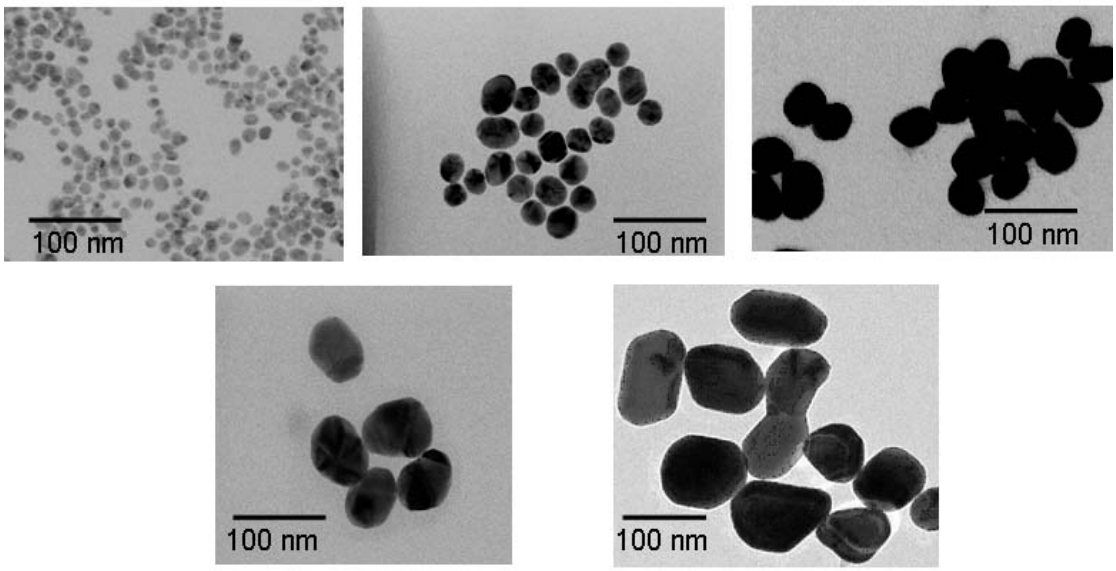

Figure S1. Transmission electron microscopy images of colloidal gold nanoparticles with sizes 14, 30, 50, 74, and 100 nm

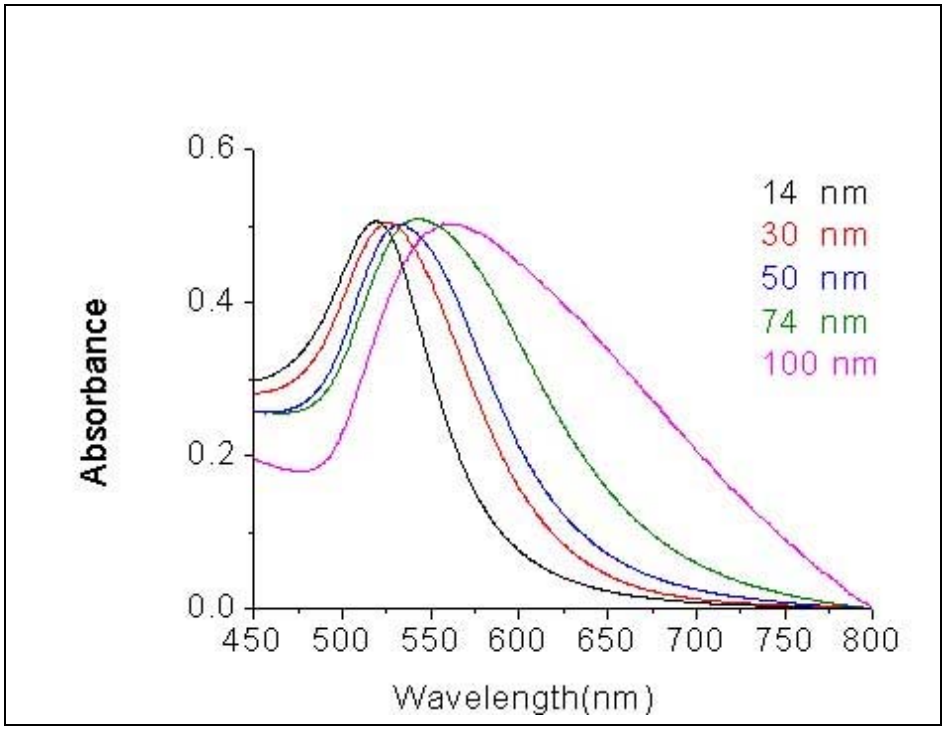

Figure S2. Optical absorption spectra of colloidal gold nanoparticles with sizes 14, 30, 50, 74, and 100 nm.

SUPPLEMENT SECTION 2

Chemical synthesis and characterization of rod-shaped gold nanoparticles (see references 28 and 29 for details). Rod-shaped gold nanoparticles were synthesized with hexadecyltrimethylammonium bromide (CTAB)) surfactant. In this reaction, CTAB (5 mL, 0.20 M) was added to (0.15, 0.25, mL) of 0.0040 M $AgNO_3$ solution at 25°C. To this solution, 5.0 mL of 0.0010 M $HAuCl_4$ was added. After gentle mixing of the solution, 70 μL of 0.0788 M of the mild reducing agent ascorbic acid was added.

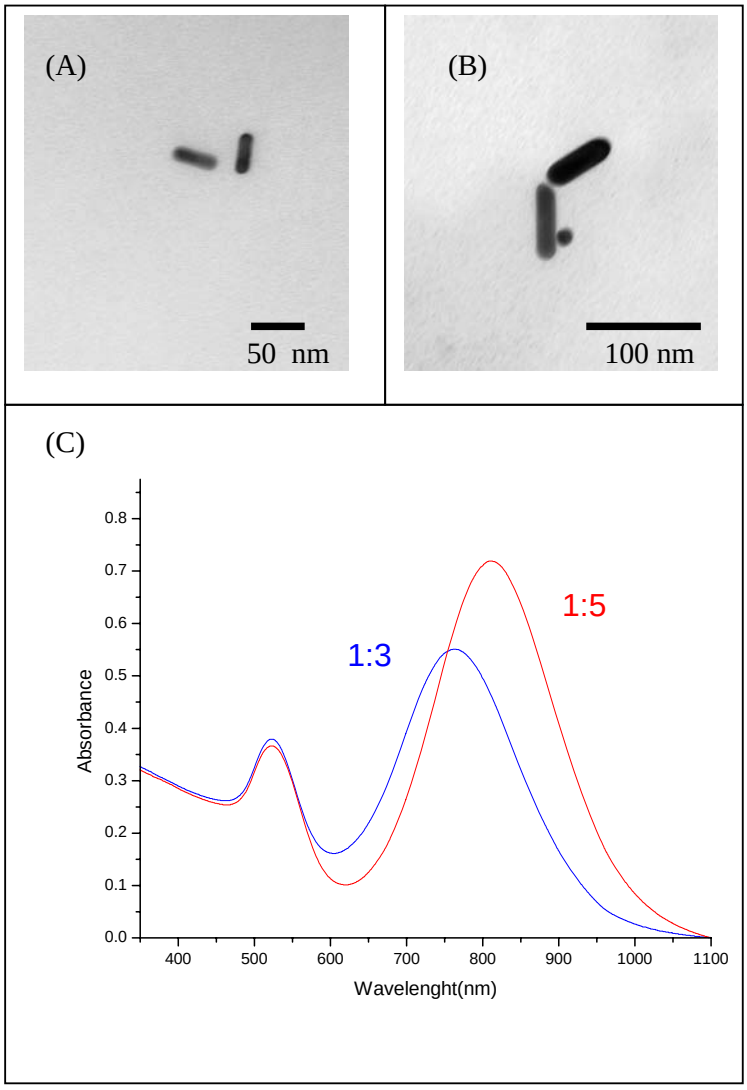

Figure S3. Characterization of rod-shaped gold nanoparticles used in the experiments. TEM images of rod-shaped gold nanoparticles with an aspect ratio of (A) 1:3 and (B) 1:5. (C) Optical absorption spectra of these rod-shaped gold nanoparticles.

SUPPLEMENT SECTION 3

Transmission Electron Microscopy (TEM) imaging of cells. Cells with internalized nanoparticles are trypsizined, centrifuged, and washed with phosphate buffered saline. Once the trypsin is removed, the cell pellet is fixed with glutaraldyhyde and formaldehyde. After one day, the pellet is washed with phosophate buffered saline to remove the fixatives and then dehydrated in an alcohol series, embedded in Epon, and sliced to a thickness of 70 nm. Images of the slices are taken with a HD 7000 transmission electron microscope. Figure S4 shows a TEM image of a Hela cell with spherical gold nanoparticles trapped inside vesicles. Figure S5 shows extra TEM images of rod-shaped gold nanoparticles with two different aspect ratios trapped inside the vesicles of cells.

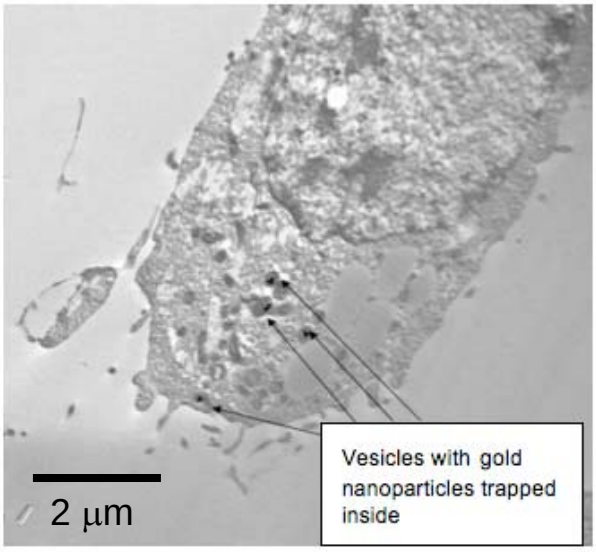

Figure S4. Image of a Hela cell with gold nanoparticles trapped in vesicles.

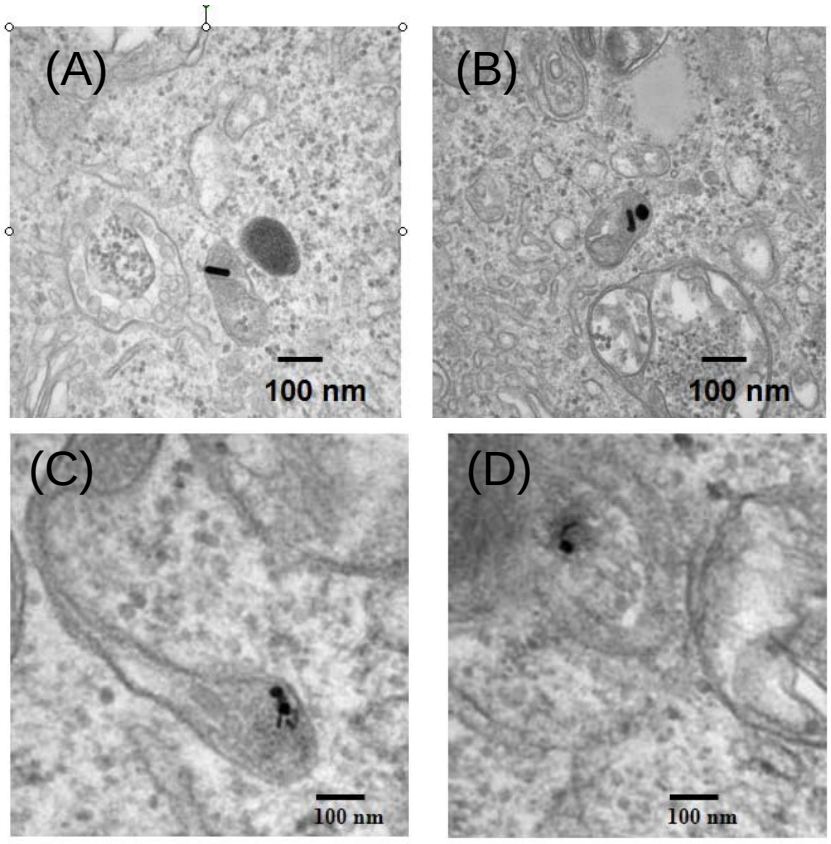

Figure S5. TEM images of rod-shaped gold nanoparticles with (A & B) aspect ratios of 1:5 and (C & D) 1:3 trapped inside the vesicles of the cells.

SUPPLEMENT SECTION 4

Transferrin was added to a solution of gold nanoparticles (in citrate buffer) and incubated for 1 hour. Afterward, the transferrin-coated gold nanoparticles were purified by centrifugation. Prior to all experiments, these transferrin-coated gold nanoparticles were titrated using NaCl to verify the coating of transferrin protein on the nanoparticle's surface. Without a protein layer, the gold nanoparticles would quick precipitate in the presence of high salt. Afterward, similar experiments were conducted for the transferrin-coated gold nanoparticles as the citrate-stabilized gold nanoparticles for determining the number of gold nanoparticles taken up by the cell.

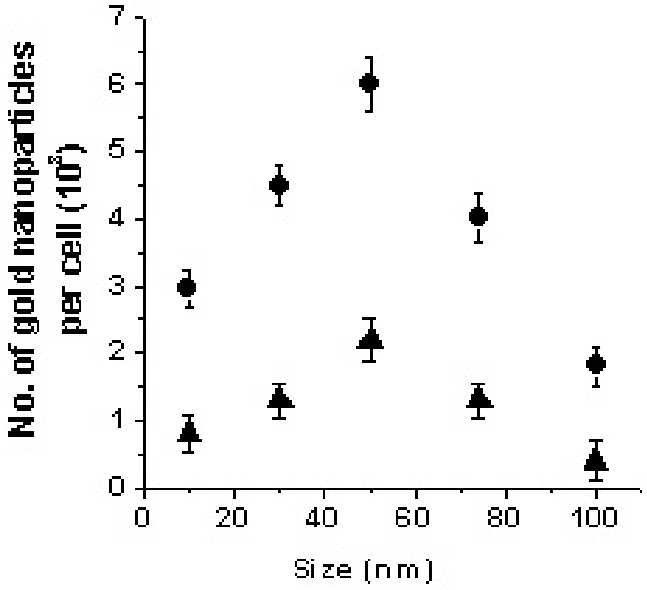

Figure S6. Dependence of the cellular uptake of gold nanoparticles after transferrin adsorption onto the surface. Uptake is higher for serum protein coated gold nanoparticles (marked with filled circles) in comparison to transferrin coated gold nanoparticles (marked with filled triangles). However, the number of transferring coated gold nanoparticles is ~ 3 times less.