Electronic Supplementary Information

Figure S1 reports the topography AFM image of SWNTs functionalized with S-TGD-1 along with the cross sectional line profile taken along a nano-object having an height of 30 nm compatible with the size of the S-TGD-1 functionalized larger diameter nanotubes imaged in the TEM micrograph of panel B of Figure 1.

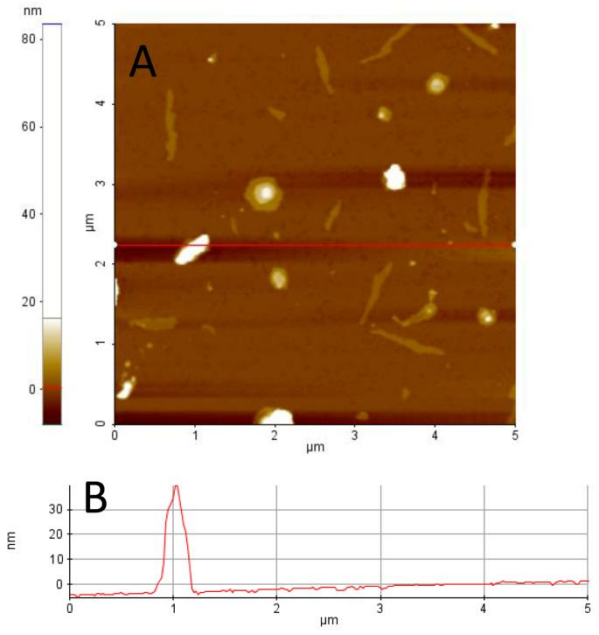

Fig. S1. (A) 2D topography AFM image of SWNTs functionalized with S-TGD-1. (B) cross sectional line profile along the red line of panel A.

Figure S2 shows the phase mode AFM image of SWNTS functionalized with S-TGD-1.

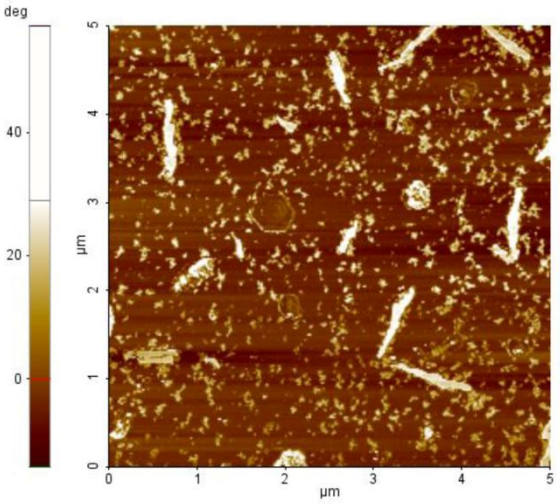

Fig. S2. 2D Phase mode AFM image of S-TGD-1 wrapping SWNTs.

Fig. S2 evidences high contrast elongated nano-objects, as well as a high contrast material, randomly distributed over the substrate and surrounding the elongated nanostructures which can be reasonably explained by S-TGD-1 wrapping the smaller diameter SWNTs.

Experimental Section

Materials: Commercial Single Walled Carbon Nanotubes (SWNTs), synthesized by a CoMoCAT process, were purchased from Sigma Aldrich[1] and used as received without any further purification. All organic solvents used were commercially distilled and they were of the highest available purity (Sigma-Aldrich). Plates for thin layer chromatography (TLC) (Silica gel 60A), obtained from Merck, were washed twice with chloroform/methanol (1:1, v/v) and activated at 120°C before use. *Isolation and purification of the archaeal glycolipid STGD1:* The archaeal glycolipid 3-HSO_3-Gal*p*-β 1,6- Man*p*-α 1,2– Glc*p*–α 1,1 -*sn*-2,3 diphytanylglycerol (S-TGD-1) is not commercial and was isolated and purified starting from the lipid extract of extreme halophilic archaeal microorganisms. The archaeal microorganism used in the study was *Halobacterium salinarum* (NRC-1 strain)*;* the microorganism cultures were grown under visible lighting at 37°C in a liquid medium containing neutralized peptone (L34, Oxoid), prepared as previously described.[2] Cells at stationary growth phase were harvested by centrifugation and immediately frozen. Total lipids were extracted from whole cells and/or cellular membranes using the Bligh and Dyer method. Total lipid extracts were analyzed by TLC in solvent A (chloroform/methanol/90% acetic acid, 65:4:35, by vol) and all lipids detected by spraying with 5% sulfuric acid, followed by charring at 120°C. The isolation and purification of individual lipid components were performed by scraping the corresponding silica band from preparative TLC plates and extracting them from the silica, as previously described.[3] The individual lipids were carefully dried under N_2 before weighing and then dissolved in

chloroform.

Preparation of the S-TGD-1 modified SWNT hybrid material: 1 mg of SWNTs was added to 1 mL of a solution 0.11 μg μL^{-1} of S-TGD-1 in chloroform. The obtained dispersion was sonicated for 1 h by a bath sonicator keeping the system at room temperature in a cooling bath. Then, the solution made of SWNTs and S-TGD-1 was left to stir vigorously overnight and it was centrifuged at 5000 rpm to separate the supernatant solution from aggregates of SWNTs.

Structural, spectroscopic and morphological characterization: Transmission electron microscopy (TEM) analysis was performed by using a Jeol Jem-1011 microscope, working at an accelerating voltage of 100 kV. TEM images were acquired by a Quemesa Olympus CCD 11 Mp Camera. The samples were prepared by dipping a 300 mesh amorphous carbon-coated Cu grid in a dilute solution of SWNTs functionalized with S-TGD-1 and allowing the solvent to evaporate.

Raman Spectroscopy was performed by using a Lab-Ram Horiba Jobin Yvon Raman system in a confocal backscattering geometry using a 632.8 nm He-Ne laser as excitation source. Low excitation laser power (10 mW) was used to minimize heating of the samples which is known to cause downshift of the peaks and appearance of defects on the nanotube walls. Raman spectra were collected by drop-casting 3 μl of both the SWNT solution and supernatant on (100) silicon wafer allowing the evaporation of the solvent. Attenuated Total Reflection Fourier Transform Infrared (ATR-FTIR) spectra were recorded by means of a PerkinElmer Spectrum One Fourier Transform Infrared spectrometer equipped both with a deuterated triglycine sulfate detector and a three-bounce, 4 mm diameter diamond microprism as internal reflection element. The resolution was 4 cm^{-1}. The measurements were performed by dropping aliquots (3–5 μl) of the chloroform solutions of SWNTs treated with S-TGD-1, directly onto the upper face of the diamond crystal and the spectra were acquired upon solvent evaporation.

Topography and phase Atomic Force Microscopy (AFM) micrographs were recorded in tapping mode, on films obtained by drop casting the samples onto silicon by using a PSIA XE-100 SPM System operating in air and at room temperature. High frequency silicon cantilevers for non-contact/tapping mode made by NanoWorld were used. Micrographs were collected by sampling the surface at a scan rate of 0.5-1.0 Hz, with a resolution of 256 × 256 pixels and scan area of 2 × 2 μm^2. AFM images were processed by using the XEI Program.

1 http://www.sigmaaldrich.com/technical-documents/articles/material-matters/manufacturing-characterization.html
2 D. Oesterhelt, W. Stoeckenius, *Methods Enzymol.* 1974, **31**,667
3 A. Corcelli, M. Colella, G. Mascolo, F. P. Fanizzi, M. Kates, *Biochemistry* 2000, **39**, 3318