The critical role of light in moderating microbial stress due mixtures of engineered nanomaterials

Supporting information

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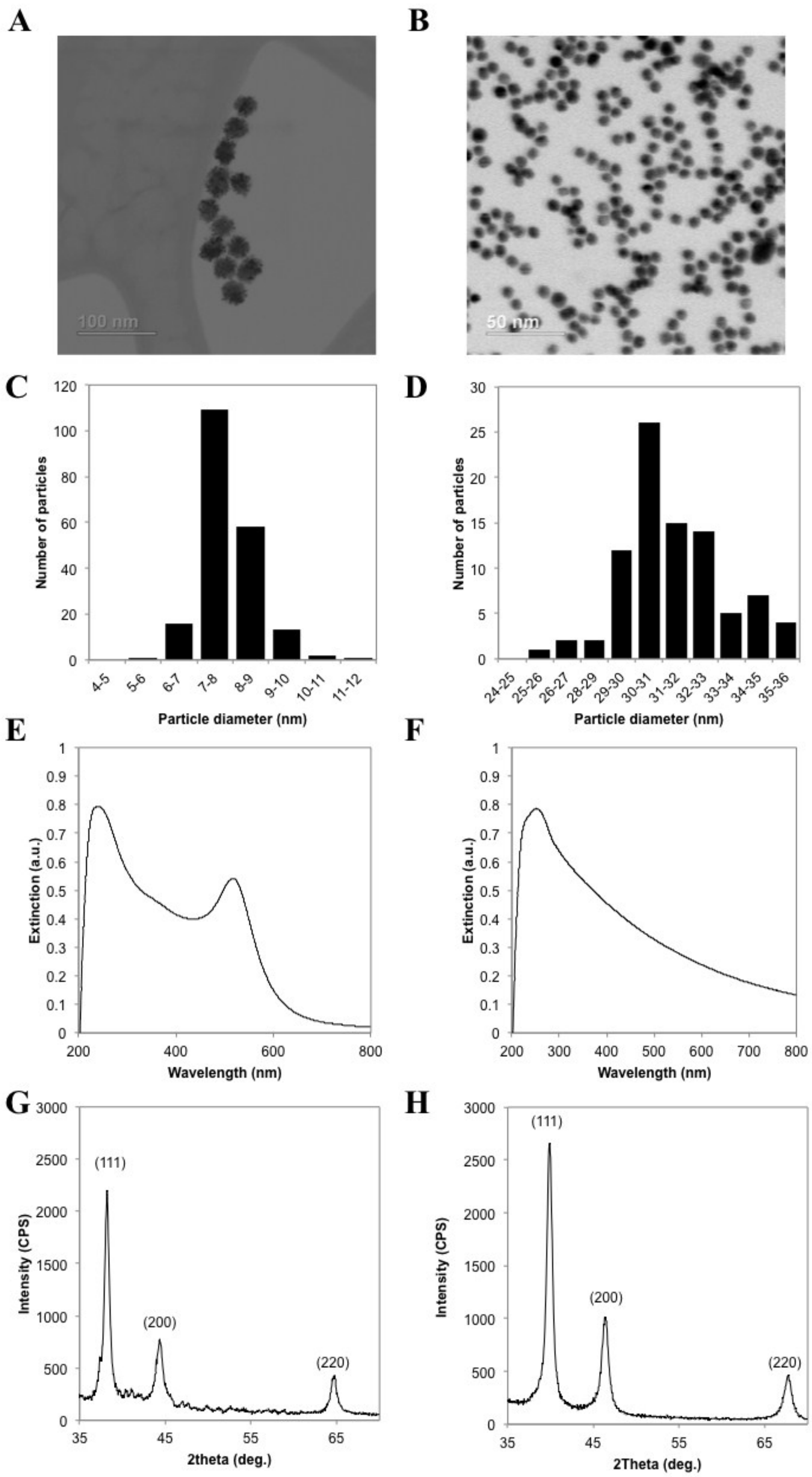


Figure S1: ENM Characterization. STEM images of (A) n-Au and (B) n-Pt. Histogram of particle size for (C) n-Au and (D) n-Pt. UV-vis extinction spectra for (E) n-Au and (F) n-Pt using a dilute citrate to and X-ray diffractogram for (G) n-Au and (H) n-Pt, showing the characteristic peaks for metals with face-centered cubic crystal structure.

	Chemical components (mM)										
DOC [a] (mg L^{-1})	Ca^{2+} [b]	Mg^{2+} [b]	Na^{+} [c]	K^{+} [c]	Cl^{-} [d]	SO_4^{2-} [d]	NO_3^{-} [d]	ΣPO_4 [e]	Alk [f] meq L^{-1}	IS [g]	pH[h]
2.41 ±0.08	0.76 ±0.07	0.41 ±0.04	0.36 ±0.02	0.035 ±0.001	0.32 ±0.05	0.21 ±0.06	0.022 ±0.009	BDL[i]	1.92 ±0.04	5.4 ±0.4	8.1 ±0.1

[a] DOC: dissolved organic carbon, measured on high-temperature combustion total organic carbon analyzer (Dohrmann Series Apollo 9000)
[b] Ca^{2+}, Mg^{2+} measured by flame atomic absorbance spectroscopy (Perkin Elmer PinAAcle 500)
[c] Na^{+}, K^{+} measured by flame atomic emission spectroscopy (GBC 932 AA)
[d] Cl^{-}, SO_4^{2-}, NO_3^{-} measured by ion chromatography (Methrom Compact IC pro Unit #881)
[e] ΣPO_4, or soluble reactive phosphorus, measured by colorimetry after reaction with molybdate [1, 2], detection limit ~ 1 μM
[f] Alk: alkalinity, measured by computerized titration using a MacIntosh ME-10 unit, a Thermo™ Scientific Orion Glass Body ROSS™ Combination Electrode, and 0.1000(+/- 0.0005) N hydrochloric acid.
[g] IS: ionic strength on the mM unit basis.
[h] measured using a Thermo™ Scientific Orion Glass Body ROSS™ Semi Micro Combination Electrode and an Accumet Research AR20 pH meter using NIST buffer solutions for calibration.
[i] BDL: Below detection limit

Table S1: Chemical characteristics of Lake Michigan Water. All measurements were done in triplicate and reported values are average ± standard deviation.

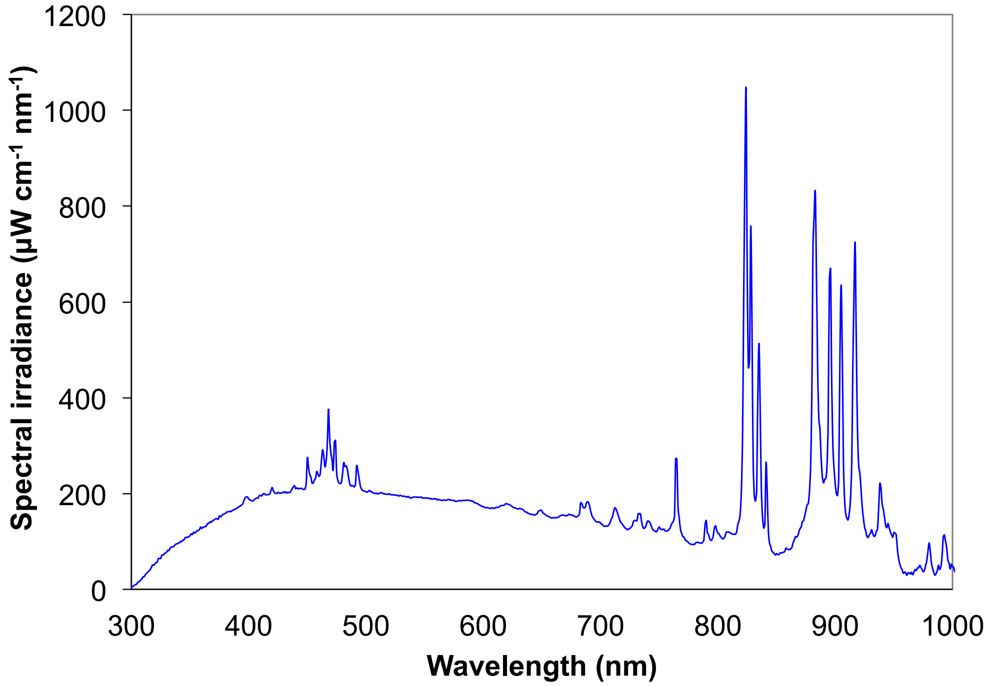


Figure S2: Spectrum of simulated solar irradiation from Xe arc lamp (1000W).

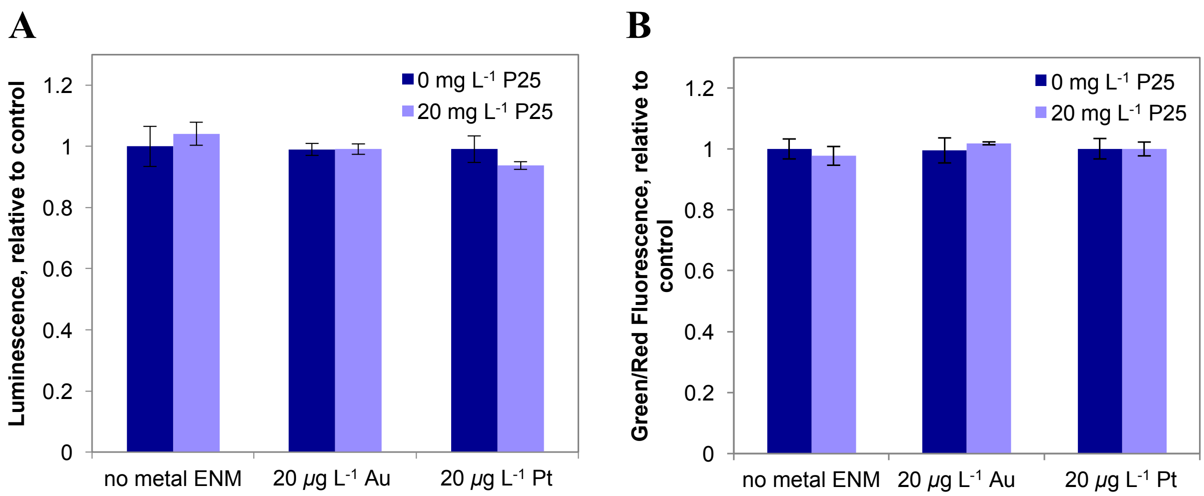
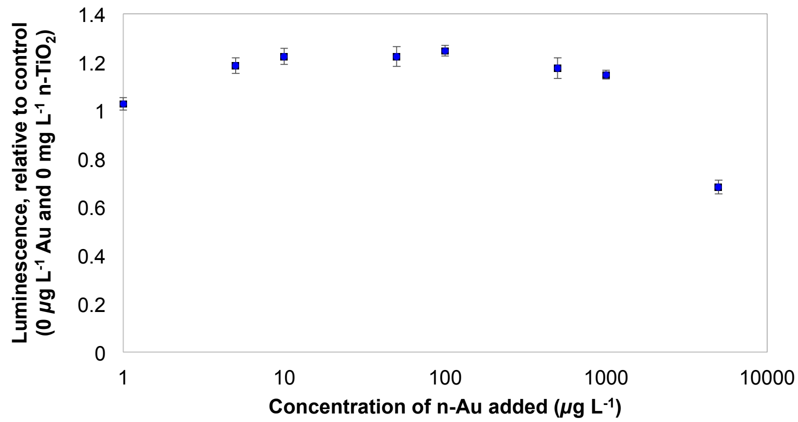


Figure S3: Potential interferences with ENMs for the (A) ATP assay and (B) BacLight cell membrane integrity assay. There was no difference observed between nanoparticle mixtures and the control (based on $p < 0.05$).

A



B

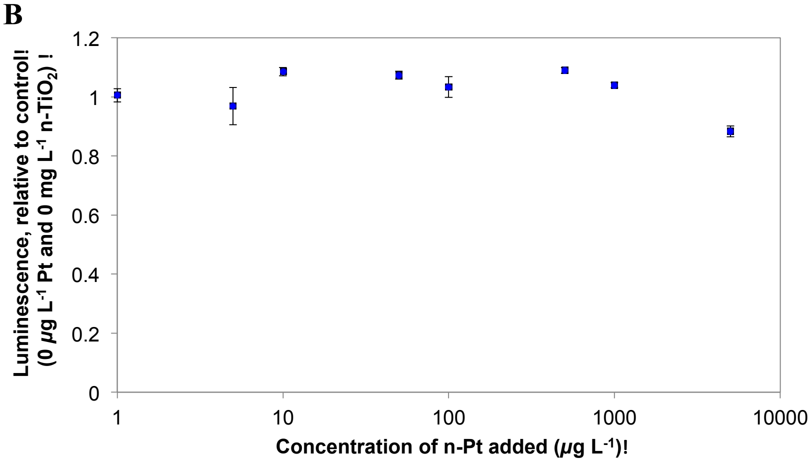


Figure S4: Dose-response curves showing sensitivity of *E. coli* ATP levels to varying concentrations of (A) n-Au and (B) n-Pt. Dose response tests were conducted under dark conditions with one hour incubation in Lake Michigan Water.

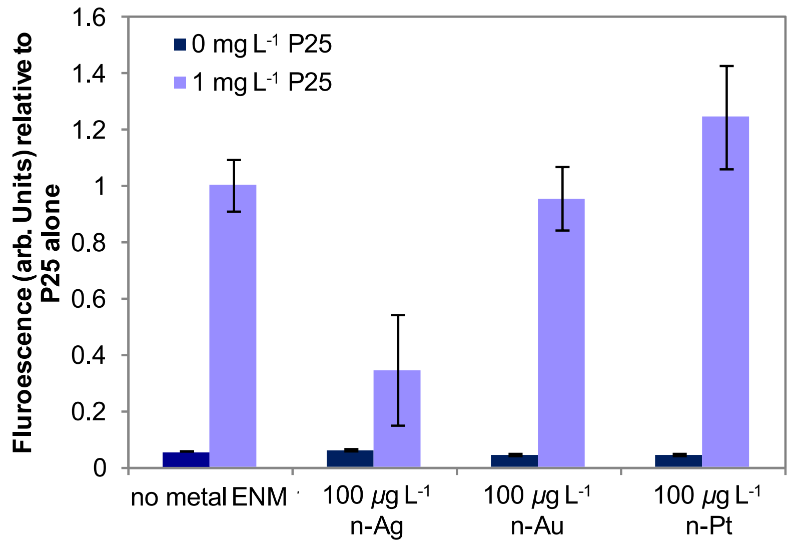


Figure S5: Fluorescence signal due to production of hydroxyl radical for 100 μg L^{-1} metal ENMs with and without 1 mg L^{-1} P25 n-TiO_2.

1. Stainton, M.; Capel, M.; Armstrong, F., Chemical analysis of fresh water. Mar. Serv. Misc. Spec. Pub. #25. **1977**, 166 p.
2. Murphy, J.; Riley, J. P., A modified single solution method for the determination of phosphate in natural waters. *Anal. Chim. Acta* **1962,** *27*, 31-36.