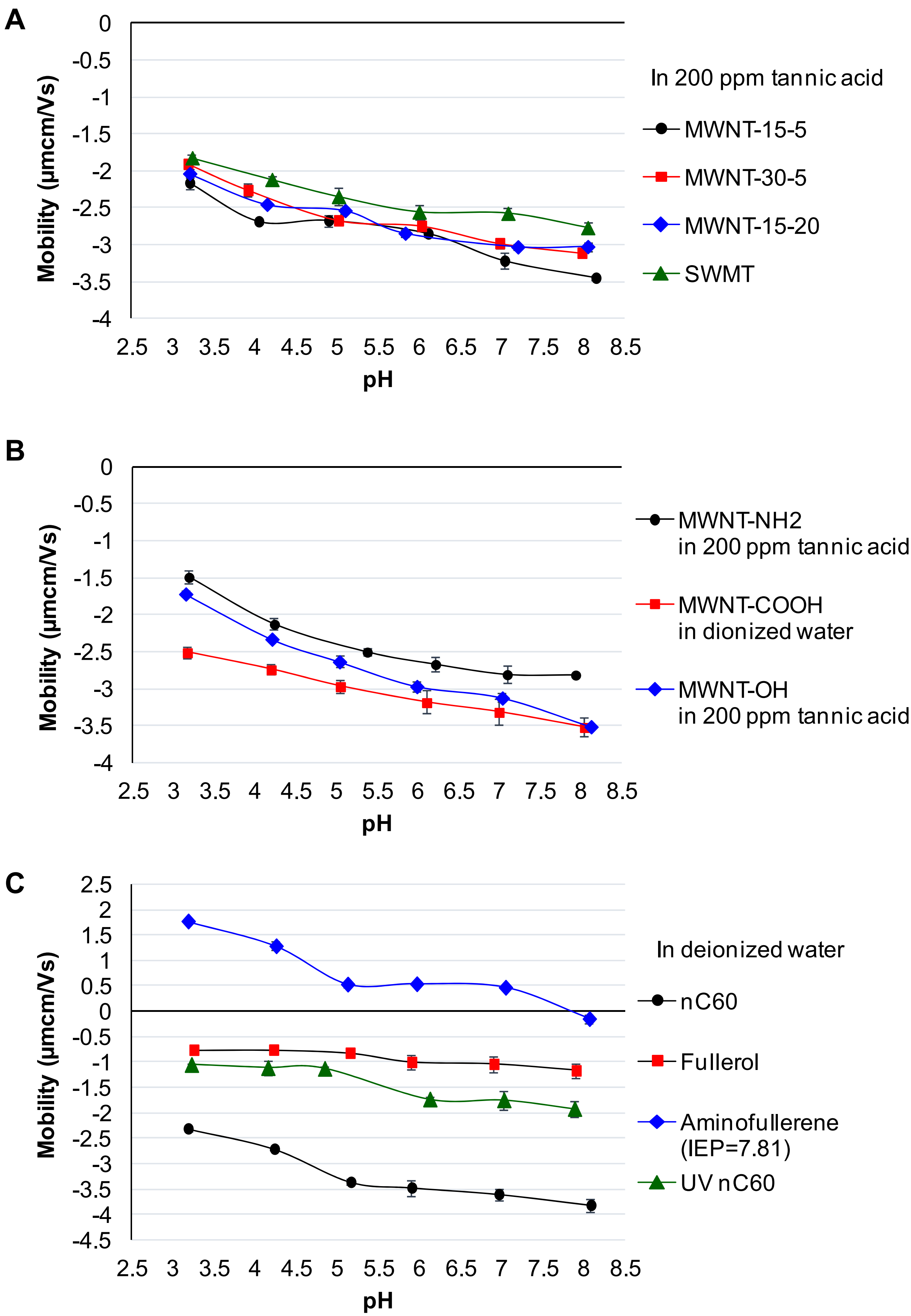

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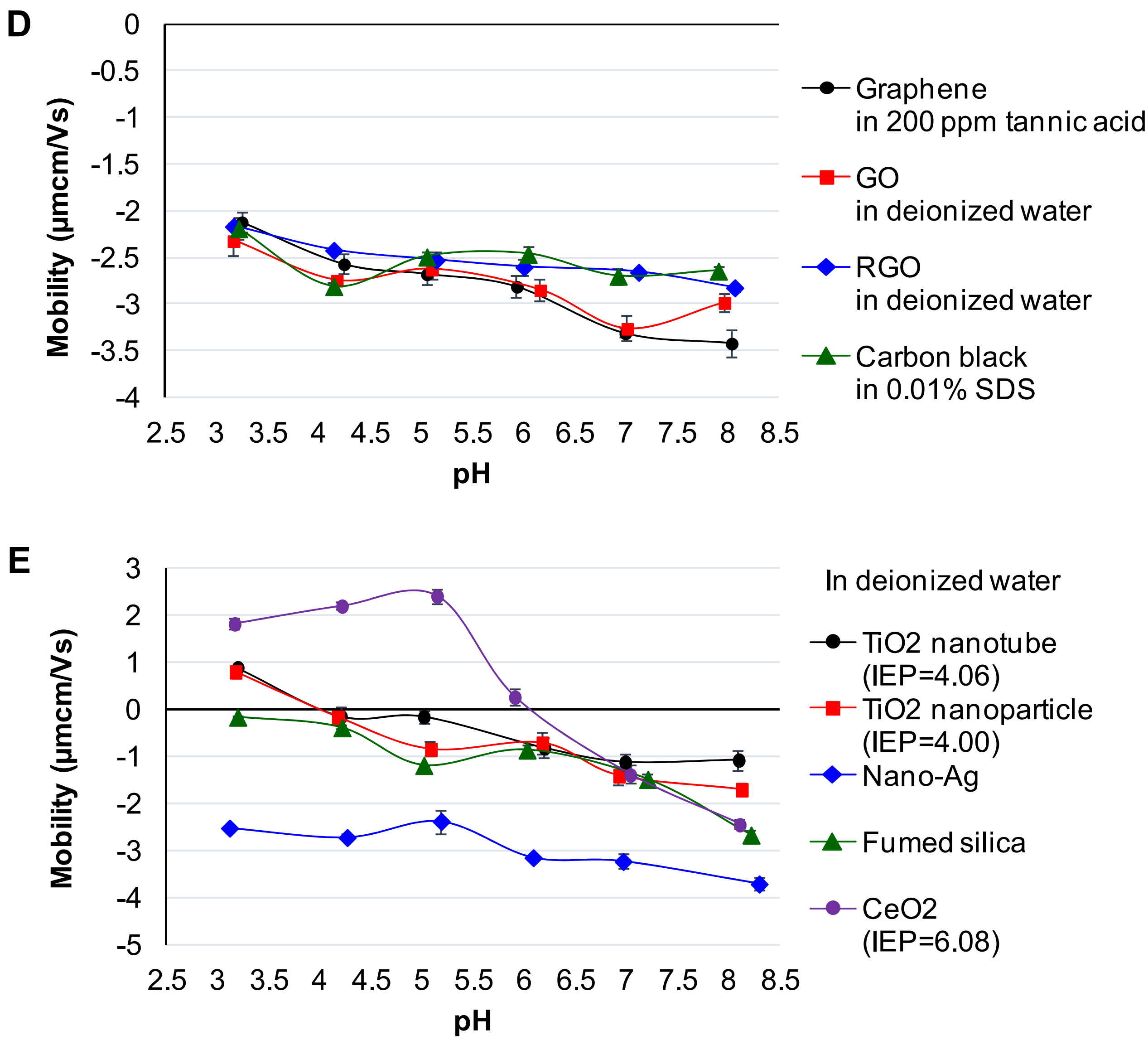


Figure S1. Electrophoretic mobility (μmcm/Vs) as a function of pH.

(A) Unfunctionalized CNTs. (B) Functionalized CNTs. (C) nC_{60}, fullerol, aminofullerene and UV nC_{60}. (D) Graphene, GO, RGO and carbon black. (E) TiO_2 nanotube, TiO_2 nanoparticle, nano-Ag, fumed silica and CeO_2. Background solutions as described in the legend. Error bars indicate standard deviation.

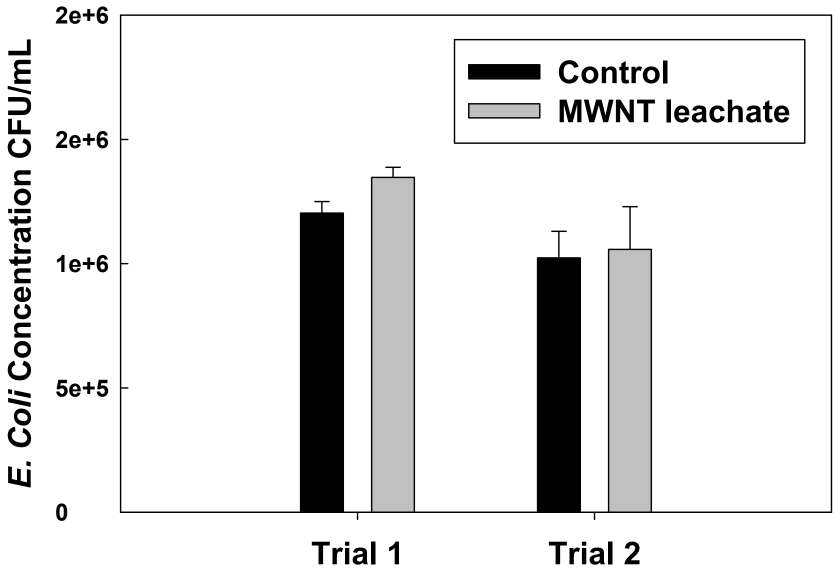


Figure S2. Compares the viable *E. coli* concentration in the control and the MWNT leachate after 3 hours of incubation. No statistically significant difference (*p* > 0.01, student's t-test) was found.
See below for more details.

Measurement of MWNT leachate toxicity on bacteria

To determine if the metal impurity in the MWNT causes any toxicity, the aqueous phase of the MWNT-15-5 stock suspension was extracted and tested for toxicity using E. coli 8739 as a model bacterium.

A suspension of MWNT-15-5 at 100 mg/L was filtered through 0.1 μm syringe filters, and the filtrate was collected for the subsequent toxicity tests. *E. coli* 8739 was grown in LB (Luria-Bertani) medium at 37 °C for 4 h and harvested in the mid-exponential growth phase. The bacterial suspension was centrifuged at 5000 rpm for 5 min to pellet the cells. Cells were washed twice with a saline solution (0.9% NaCl) to remove residual nutrients and re-suspended in the saline solution to obtain an OD_{600nm} of 0.1. The resulting bacterial suspension was further diluted by 10 times using saline solution for the following toxicity test.

3 mL of the filtrate was mixed with 3 mL of the bacterial suspension and incubated at room temperature for 3 hours. The saline solution was used as the control. Viable bacteria were enumerated by plate counting. Duplicate experiments were performed with triplicate samples in each experiment.

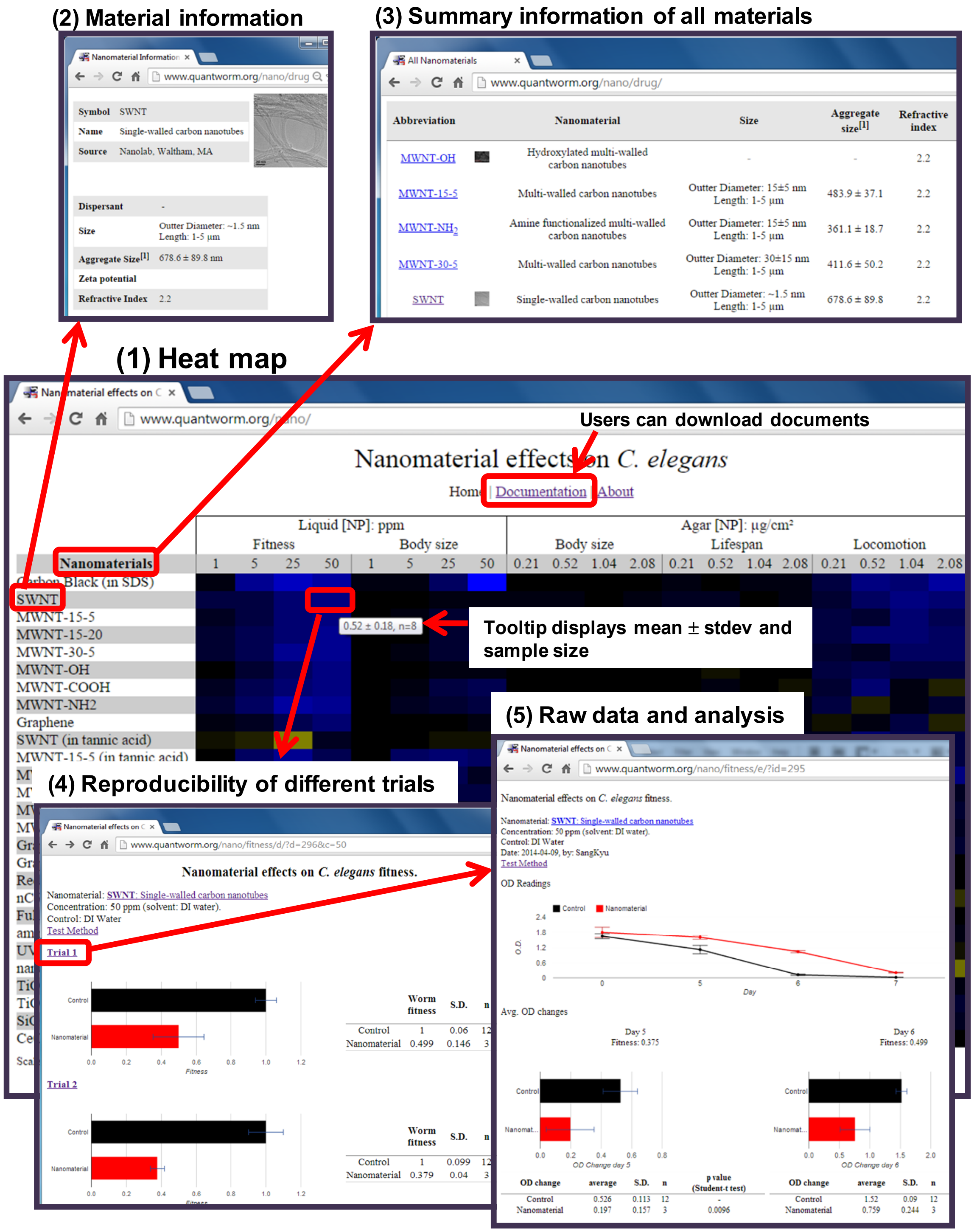
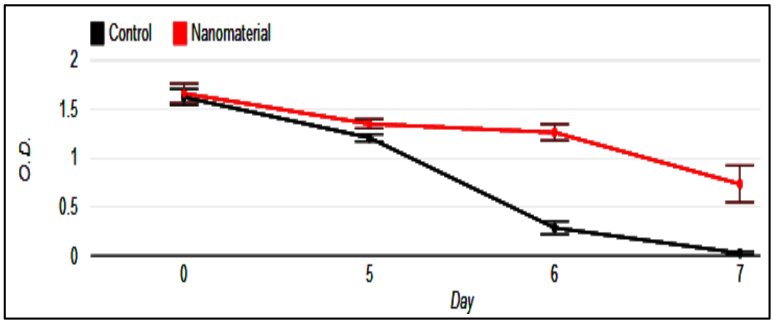
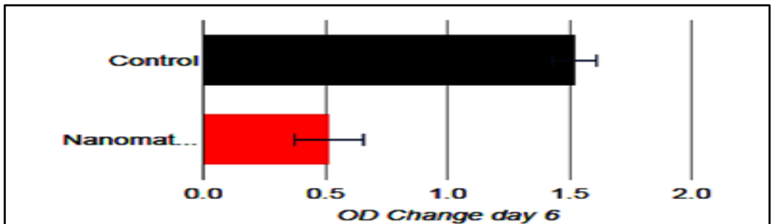


Figure S3. Interface of nanotoxicity database. (1) Nanotoxicity database is located at www.quantworm.org/nano. The main webpage shows a summary heat map of toxicity endpoints of all different nanomaterials at various test conditions. Users can navigate other web pages by clicking on texts or images as marked by red boxes. Users can also download documents and software at the documentation page. (2) The material information page includes a chemical's full name, properties, source, suspension preparation method, characterization method, and microscope image (SEM or TEM). (3) The summary information page lists all tested chemicals. (4) The trial page lists statistics from different independent trials. (5) The raw data page includes additional analysis, measurements, and images. The raw data page is described further in Figure S3.

A. Fitness analysis



OD change over time



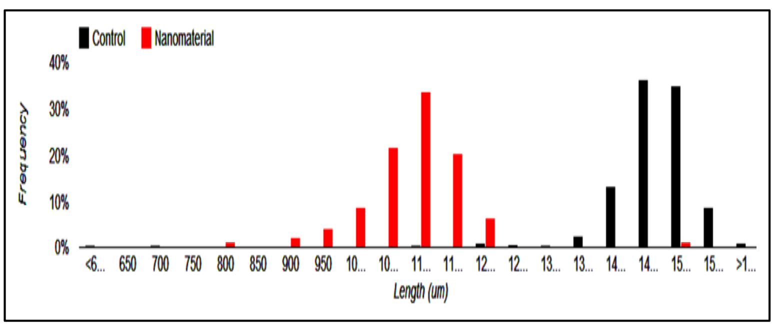
OD change	average	S.D.	n	p value (Student-t test)
Control	1.52	0.09	12	-
Nanomaterial	0.516	0.142	3	2.2e-9

Statistical analysis

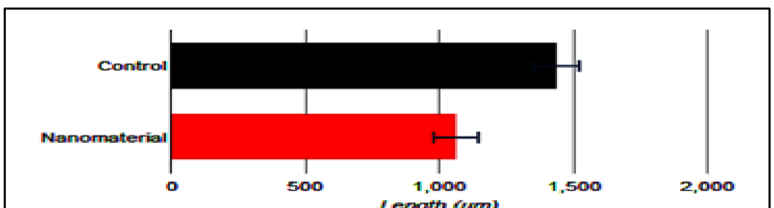
	Well	Day 0	Day 5	Day 6	Day 7
Control	1	1.7223	1.0353	0.2115	0.135
	2	1.7946	1.1712	0.2424	0.1422
	3	1.7304	1.356	0.2436	0.1308
	4	1.794	1.4421	0.2742	0.135
	5	1.7916	1.3152	0.2442	0.144
	6	1.986	1.4037	0.2793	0.1425
	7	1.5672	1.0488	0.2403	0.1362
	8	1.6644	0.9339	0.1968	0.1365
	9	1.7817	1.1928	0.2658	0.1341
	10	1.677	1.1643	0.1968	0.1428
	11	1.746	1.2639	0.2745	0.1377
	12	1.8666	1.4481	0.2262	0.1455
Nanomaterial	1	2.0085	1.5678	1.3191	0.8478
	2	1.8183	1.656	1.458	1.0578
	3	2.0334	1.6692	1.413	1.0227
Control without bacteria	1	0.1149	0.1125	0.1164	0.1134
	2	0.1161	0.1164	0.1167	0.1155
	3	0.1113	0.1086	0.1143	0.1149
	4	0.1149	0.1131	0.1173	0.1128
	5	0.1119	0.1089	0.1122	0.114
	6	0.1155	0.1131	0.1215	0.1155
	7	0.117	0.1137	0.1155	0.1152
	8	0.1152	0.1137	0.1179	0.1155
	9	0.1167	0.1122	0.1158	0.1158
	10	0.1146	0.1134	0.1149	0.1158
	11	0.1158	0.1104	0.1167	0.1143
	12	0.1152	0.1128	0.1182	0.1203
Nanomaterial without bacteria	1	0.1389	0.2466	0.1764	0.1419
	2	0.219	0.2262	0.1578	0.1458
	3	0.3084	0.3849	0.2106	0.1575

Raw data

B. Body size analysis



Size distribution

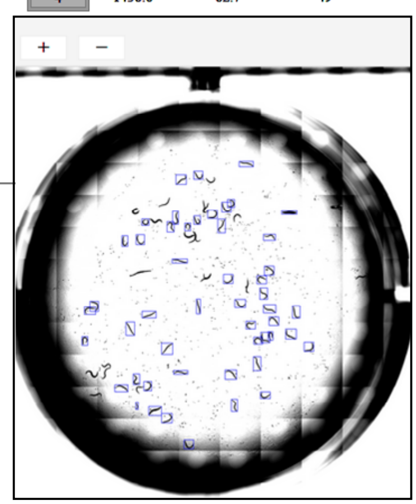


	Worm length average (µm)	S.D.	n	p value (Student's t-test)
Control	1436.4	85.8	400	-
Nanomaterial	1061.8	84.1	92	4.6e-75

Statistical analysis

Raw Data

	Well	Worm length average (µm)	S.D.	n
Control	1	1426.8	120.4	50
	2	1452.6	41.2	44
	3	1448	43	43
	4	1438.6	82.7	49
Nanomaterial				



Source image and data

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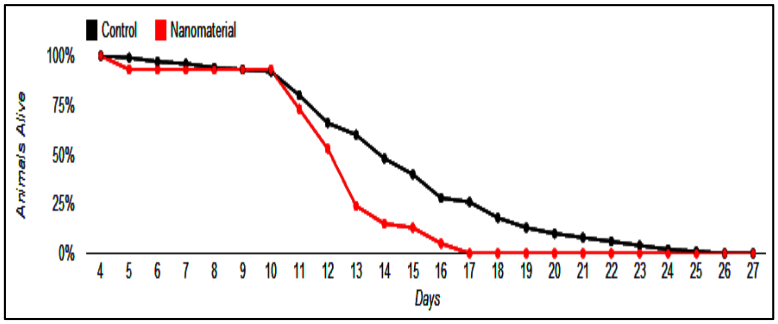
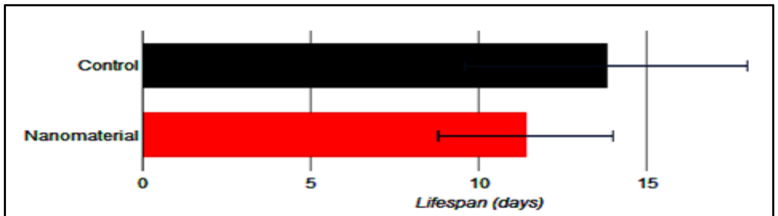
C. Lifespan analysis



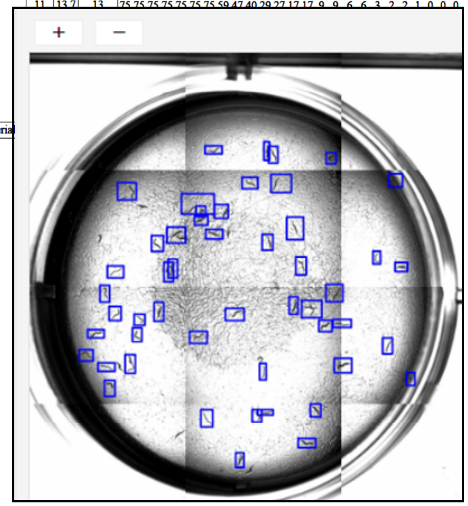
Survival curve



	Worm lifespan average (days)	S.D.	n	p value (LogRank test)
Control	13.8	4.2	1211	-
Nanomaterial	11.4	2.6	55	1.2e-8

Statistical analysis

	Well	Lifespan		Number of living worms on each day																								
		Avg.	Median	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28
Control	1	12.8	13	60	60	60	60	58	50	50	43	43	31	21	18	14	9	4	2	2	0	0						
	2	13	13	78	77	77	77	71	71	71	57	50	42	33	33	17	9	9	1	1	1	1	1	0	0			
	3	12.7	14	64	64	59	59	55	55	55	49	39	39	35	18	13	13	4	1	0	0	0						
	4	11.7	12	70	63	63	56	55	55	55	51	38	27	23	21	9	9	4	4	1	1	1	0	0	0			
	5	12.7	12	72	71	71	67	67	67	63	63	38	26	26	24	14	14	8	2	2	2	1	1	1	0	0		
	6	13	13	70	70	65	65	63	63	63	58	45	37	28	28	21	16	5	3	1	0	0						
	7	14.6	14	65	65	65	64	64	64	64	53	43	43	34	25	17	17	17	13	8	8	7	7	5	5	1	0	0
	8	13.2	13	69	61	61	61	61	61	61	51	41	38	28	24	19	19	19	10	10	8	5	0					
	9	14.4	15	59	59	59	59	59	59	59	46	40	40	31	31	19	15	15	9	5	2	2	2	1	0	0		
	10	12.1	11	61	61	61	58	58	58	44	40	30	28	14	12	11	11	4	2	0	0	0	0					
	11	13.7	13	75	75	75	75	75	75	75	59	47	40	29	27	17	17	9	9	6	6	3	2	2	1	0	0	0
Nanomateria																												

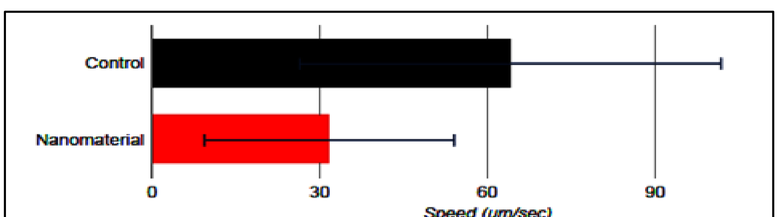


Source image and data

D. Locomotion analysis

	Well	Tracks from daily videos		
		Day 7	Day 8	Day 9
Control	1	13 tracks	9 tracks	7 tracks
	2	12 tracks	19 tracks	7 tracks
	3	21 tracks	24 tracks	11 tracks
	4	11 tracks	14 tracks	13 tracks
	1	10 tracks	1 tracks	

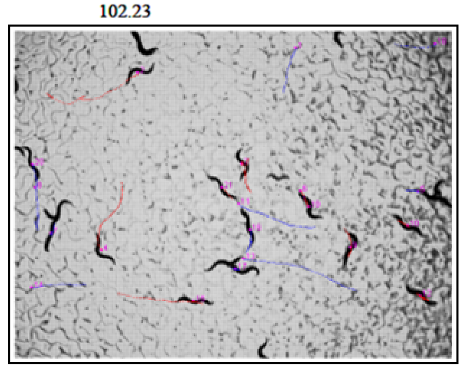
Detection summary



	Worm speed average (µm/sec)	S.D.	n	p value (Student's t-test)
Control	64.129	37.628	161	-
Nanomaterial	31.745	22.292	40	3.5e-12

Statistical analysis

Track #	Speed of track (µm/sec)
1	93.72
2	110.92
3	66.14
4	82
5	24.89
6	68.98
7	25.82
8	66.77
9	38.49
10	20.27
11	102.23
12	
13	
14	
15	
16	
17	
18	
19	
20	
21	



Source video and data

(Continued on next page)

Figure S4. Different webpage designs to visualize different types of nanotoxicity raw data.
MWNT-15-5 is chosen as an example for figures A-D. (A) Fitness data are shown as line plots displaying change in OD_{595} over time, bar graphs summarizing statistics, and daily OD_{595} numbers for each sample. (B) Body size results are presented as histograms showing animal length distribution, bar graphs summarizing statistics, and source images and measurements for each well. In addition, length for each animal can be downloaded by clicking "Raw Data." (C) Lifespan results presented as survival curves, bar graphs summarizing statistics, and tables showing the number of live animals in each well in each day. Users can click the number on the table to display the source images of the well. The source images are two time-lapse images taken two minutes apart with live (moving) animals marked. (D) Locomotion results are displayed as bar graphs summarizing statistics and tables showing the number of tracks detected in each video. Clicking the image or text in the table leads a user to the raw data page where the speed of each track is displayed. The raw data page also displays the last frame of the video with all tracks marked. Clicking on this image downloads the source video.

Tablet S1. Summary of former nanotoxicity studies in *C. elegans*.

reference	ENM	modification	size	exposure media	food supply	[ENM]	worm developmental stage	exposure duration	endpoints
Rho et al. (2009)[1]	nano-Ag	pristine	20 nm	aqueous (k-medium)	no	0.05-0.5 ppm[a]	adult	24-hr	reduced growth and survival ratio
								72-hr	reduced reproduction
Meyer et al. (2010)[2]	nano-Ag	coated with citrate	7 nm	aqueous (k-medium)	yes	0.5-50 ppm	adult	72-hr	shortened body length
		coated with PVP[b]	17 nm 75 nm						
Kim et al. (2012)[3]	nano-Ag	coated with citrate	D_h[c]=50.6 nm	solid		10-1000 ppm	adult	24-hr	LC50[d]: 55 ppm
						1-10 ppm	adult	48-hr	EC50[e] (reproduction): > 100 ppm
Lim et al. (2012)[4]	nano-Ag	pristine	20-30 nm	aqueous (k-medium)	no	0.1-1 ppm	adult	72-hr	reduced reproduction
Ellegaard-Jensen et al. (2012)[5]	nano-Ag	pristine	1 nm	aqueous (k-medium)	yes	0.5-10 ppm	L2	72-hr	LC50: 4.4 ppm
		coated with PVP	28 nm						LC50: 2.8 ppm
Contreras et al. (2014)[6]	nano-Ag	pristine	2 nm 5 nm 10 nm	solid	yes	30 μL of 1-100 ppm	L4	full generation	shortened mean lifespan
							L4	24-hr	shortened body length
Ahn et al. (2014)[7]	nano-Ag	pristine	D_h=35.1 nm	aqueous			adult	24-hr	LC50: 0.041 ppm
		coated with PVP	8 nm; D_h=47.7 nm						LC50: 0.607 ppm
			38 nm; D_h=108 nm						LC50: 3.262 ppm
Hunt et al. (2014)[8]	nano-Ag	coated with citrate, PVP, polyethylene glycol, or branched polyethyleneimine	20 nm 110 nm	aqueous		6.25-100 ppm	lethality: adult; growth: L1	lethality: 24-hr; growth: 3-7 days	several endpoints measured (lethality, larval growth, mobility, gene expression, and uptake rate); toxicity ranking: polyethylene glycol > PVP～=branched polyethyleneimine> citrate coated nano-Ag
Fajardo et al. (2014)	nano-Ag	pristine	40 nm	solid (NPs-treated soils)	yes	~10^{-5} mg/g soil	L1	4-day	no significant changes in growth, survival, or reproduction
	Al_2O_3	pristine	50 nm			4 mg/g soil			
Wu et al. (2011)[9]	Al_2O_3	pristine	60 nm	aqueous	yes	6.3-203.9 ppm	L1	24-hr	reduced survival ratio
							L4	24-hr	reduced survival ratio
							adult	24-hr	reduced survival ratio
Yu et al. (2011)[10]	Al_2O_3	pristine	60 nm	aqueous (k-medium)	yes	8.1-203.9 ppm	adult	24-hr	similar intestinal autofluorescence intensity to control up to 30.6 ppm

reference	ENM	modification	size	exposure media	food supply	[ENM]	worm developmental stage	exposure duration	endpoints
				solid	yes	8.1-30.6 ppm	adult	10-day	increased intestinal autofluorescence intensity at 8.1 ppm
Li et al. (2012)[11]	Al_2O_3	pristine	60 nm	solid	yes	-500 μL of 23.1 ppm	adult	10-day	reduced head thrash frequency and body bend frequency at 23.1 ppm
Li et al. (2013)[12]	Al_2O_3	pristine	60 nm	aqueous	yes	12.5-50 ppm	L4	6-hr 12-hr	reduced survival ratio at 50 ppm (12-hr exposure); reduced head thrash frequency or bend frequency at 50 ppm (12-hr exposure)
Wang et al. (2009)[13]	Al_2O_3	pristine	60 nm; D_h=763 nm	aqueous	yes	10.2-407.8 ppm	L1	5-day	shortened body length 102 ppm; LC50 = 81.6 ppm
	TiO_2	pristine	50 nm; D_h=550 nm			24-239.6 ppm			shortened body length at 168 ppm; LC50 = 79.9 ppm
	ZnO_2	pristine	20 nm; D_h=759 nm			0.4-8.1 ppm			shortened body length at 1.6 ppm; LC50 = 2.2 ppm
Ma et al. (2009)[14]	ZnO_2	pristine	2-6 nm	aqueous		325-1625 ppm [Zn]		24-hr	LC50: 884 ppm
Khare et al. (2011)[15]	TiO_2	pristine	D_h: < 25 nm D_h: < 100 nm	aqueous	no	0-500 ppm	L4	24-hr	similar mortality(%) to control up to 50 ppm TiO_2 size of 100 nm
	ZnO_2	pristine	D_h: < 25 nm D_h: < 100 nm			0-40 ppm			LC50 of size < 25 nm = 0.32 ppm LC50 of size < 100 nm = 2 ppm
Wu et al. (2013)[16]	TiO_2	pristine	30 nm	-aqueous		0-0.05 ppm	L1	over 48-hr	reduced survival ratio; shortened body length at 0.05 ppm
	ZnO_2	pristine							reduced survival ratio; shortened body length at 0.05 ppm
	SiO_2	pristine							similar survival ratio and body length to control at 0.05 ppm
Pluskota et al. (2009)[17]	SiO_2	pristine (and fluorescent labeled NPs)	50 nm	solid	yes	7.1-142 μg/cm^2	L4	full generation	similar lifespan to control; decreased brood size; increase BOW (bag of worm) phenotype
								72-hr	reduced reproduction
Li et al. (2009)[18]	TiO_2	pristine	4 nm 10 nm 60 nm 90 nm	aqueous	yes	0-0.01 ppm	L1	over 48-hr	reduced survival ratio, body length, and brood size at 0.01 ppm (10 nm TiO_2)
Rui et al. (2013)[19]	TiO_2	pristine	10 nm	aqueous	yes	0.02-25 ppm	adult	24-hr	no significant changes in survival ration, body length, and brood size

reference	ENM	modification	size	exposure media	food supply	[ENM]	worm developmental stage	exposure duration	endpoints
Angelstorf et al. (2014)[20]	TiO_2	pristine	21 nm	aqueous (M9 medium)	yes	1-100 ppm	L1	4-day	reduced growth and reproduction
Roh et al. (2010)[21]	TiO_2	pristine	7 nm 20 nm	aqueous (k-medium)	no	1 ppm		24-hr	shortened body length; reduced eggs/worm
	CeO_2	pristine	15 nm 45 nm	aqueous (k-medium)	no	1 ppm		24-hr	no significant effect on body length; reduced eggs/worm
Zhang et al. (2011)[22]	CeO_2	pristine	8.5 nm	solid	yes	1-100 nM	L1	full generation	shortened mean lifespan at 100 nM
Arnold et al. (2013)[23]	CeO_2	pristine	D_h=53.34	aqueous	yes (inactviated *E. coli* used)	2.5-93.75 ppm	L1	72-hr	reduced growth at 25 ppm
Tsyusko et al. (2012)[24]	gold	coated with citrate	4 nm	aqueous (k-medium)		2.5-30 ppm	L3	12-hr	LC 10%: 5.9 ppm
Kim et al. (2013)[25]	gold	pristine	10 nm	maternal food-exposure assay in solid media	yes	5-50$\times10^{10}$ particles/mL (exposed to *E. coli*)		12-hr	no significant changes in survival ratio and reproduction up to 50$\times10^{10}$ particles/mL; reduced reproduction rate in F2
Kim et al. (2008)[26]	Pt	pristine	2.4 nm	aqueous	yes	0.1-1 mM	L4	full generation	increase lifespan;
Contreras et al. (2013)[27]	core (CdSe) QDs	pristine	3.4 nm; D_h=17 nm	solid	yes	30 μL of 10-300 ppm [Cd]	L4	full generation	no significant changes in lifespan, fertility, and locomotion at 10, 50, and 100 ppm [Cd]
								24-hr	shortened body length at 100 ppm [Cd]
	core-shell (CdSe/ZnS) QDs	pristine	4.1 nm (core diameter); D_h=17 nm	solid	yes	30 μL of 10-300 ppm [Cd]	L4	full generation	reduced brood size at 50 ppm [Cd] of core quantum dots
								24-hr	
Hsu et al. (2012)[28]	core-shell (CdSe/ZnS) QDs	capped with MSA[f]	5.8 nm; D_h=6.5 nm	aqueous (k-medium)	yes	0.039-1.25 μM	L3	24-hr	no significant change in mortality
				solid	yes	10 μL of 0.01-1 μM	L4	6-day	similar body length of F2 (second generation) to control up to 1 μM
								full generation	shortened mean lifespan at 1 μM
								over 6-day	reduced eggs/worm; increased egg-laying defects at 1 μM

reference	ENM	modification	size	exposure media	food supply	[ENM]	worm developmental stage	exposure duration	endpoints
Qu et al. (2011)[29]	core-shell (CdSe/ZnS) QDs	capped with MEA[g]	D_h=5 nm	solid	yes	20 nM	L1	14-hr to 4-day	similar body length to control
	core-shell (CdSe/ZnS) QDs	capped with MPA[h]						full generation	similar lifespan to control
								14-hr to 4-day	shortened body length under 4-day exposure; similar body length to control (3-day exposure); similar brood size to control
Chen et al. (2013)[30]	SWNT	pristine	diameter: 73 nm; length: 2.2 μm	aqueous	yes	100-500 ppm	L1	48-hr	similar body length to control at 100 ppm
									reduced survival ratio at 100 ppm
		amide-modified	length: 200-900 nm						no significant change in body length at 500 ppm
Goodwin et al. (2014)[31]	SWNT	oxidized	diameter: 1.5 nm; length: 1-5 μm	aqueous (M9 medium)	no	50-250 ppm	L4	3-hr	similar survival ratio to control
				solid	yes	200 μL of 250 ppm	adult	full generation	similar lifespan to control
		cysteine functionalized		aqueous (M9 medium)	no	50-250 ppm	L4	3-hr	similar survival ratio to control
				solid	yes	200 μL of 250 ppm	adult	full generation	similar lifespan to control
Nouara et al. (2013)[32]	MWCNT	pristine	length: 5-15 nm; diameter: 10-20 nm	aqueous	yes	0-1 ppm	L1	72-hr	reduced brood size, head thrash frequency and head bend frequency at 1 ppm
	MWCNT	carboxylic acid functionalized							reduced brood size, head thrash frequency and head bend frequency at 1 ppm
Cha et al. (2012)[33]	fullerol	pristine	D_h=4.7 and 40.1 nm	solid	yes	50 μL of 100 ppm	L4	full generation	shortened mean lifespan
								5-day	shortened body length
Cong et al. (2015)[34]	fullerol	pristine	D_h=50-200 nm	solid		0.01-100 μM	L1	3-day	similar survival ratio to control up to 100 μM; similar body length to control under 24-hr, 48-hr, and 72-hr exposure to NP; increased brood size at 1 μM; decreased pumping rate; increased body bending rate at 1 μM
Zanni et al. (2012)[35]	fullerol	pristine		aqueous	no	100 ppm	adult	3-hr	reduced brood size at 100 ppm; reduced survival ratio at 100 ppm at

reference	ENM	modification	size	exposure media	food supply	[ENM]	worm developmental stage	exposure duration	endpoints
									day 3
				solid	yes	200 μL of 100 ppm	L1	full generation	shortened mean lifespan at 100 ppm
	graphite nanoplatelets	pristine	9 nm	aqueous	no	50-250 ppm	adult	3-hr	reduced brood size at 250 ppm; reduced survival ratio at 100 ppm at day 3
				solid		200 μL of 100-250 ppm	L1	full generation	increased mean lifespan at 100 ppm
Zhang et al. (2011)[36]	metallo-fullerol	modified with Gd	D_h=22 nm	solid	yes	0.01-10 ppm	L1	full generation	no significant changes in lifespan and thermotolerance to control up to six generations
								72-hr	no significant changes in body length and pumping rate
Zhang et al. (2012)[37]	GO	pristine	D_h=80 nm	solid		5-20 ppm		full generation	similar mean lifespan (~4% reduction; $p > 0.05$) to control up to 20 ppm
	GO	modified with PEGylated poly-L-lysine	D_h=106 nm						similar mean lifespan to control up to 20 ppm
Wu et al. (2013, 2014)[38, 39]	GO	pristine	thickness: 1 nm; D_h=72 nm	aqueous	yes	0.1-100 ppm	L4	24-hr	reduced brood size, head thrash frequency and head bend frequency at 100 ppm
							L1	over 3-day	reduced brood size, head thrash frequency and head bend frequency at 100 ppm
Mohan et al. (2010)[40]	fluorescent nanodiamond	pristine	D_h=120 nm	solid	yes	30 μL of 1000 ppm	L4	3-hr	no significant changes in lifespan, brood size, and ROS level
		modified with detran or bovine serum albumin							

[a]mg/L. [b]Polyvinylpyrrolidone. [c]Hydrodynamic diameter. [d]Median lethal concentration. [e]Median effective concentration. [f]Mercaptosuccinic acid. [g]2-mercaptoethylamine. [h]3-mercaptopropionic acid.

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