Supporting Information

Toxicity Mechanisms Identification via Gene Set Enrichment Analysis of Time-Series Toxicogenomics Data: Impact of Time and Concentration

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41 Table S1. Genes included in the E.coli stress response ensemble assay library for toxicogenomics
42 assessment[1]

Category		Gene selected	Known functions
DNA stress		*uvrA, recE, clpB, recX, ada, dinB, mutT, nfo, ding, ftsk, recN, sbmC, ybfE, dnaQ, mutH, mutM, mutS, mutY, yjiW, mug, yebG, sulA, lexA, polB, recA, ssb, umuD, uvrD, ruvA, uvrC, uvrY, polA*	DNA strand breaks and cross-linking, alter superhelicity, oxidative DNA damage, DNA alkylation, inhibition of DNA synthesis and replication
Redox stress		*soxS, soxR, oxyR, inaA, dps, ahpF, katG, sodA, ahpC, katE , ytfE, katE, sodB, sodC*	Increased levels of superoxides, increased levels of peroxides, any other conditions which alter the redox potential of the cell.
Detoxification		*norR, fpr, tam, yeiG, yafN, yeaE, grxA, gst*	Organisms protect themselves against the harmful effects of toxic compounds
Protein stress		*clpB, ycgE, cueR, entC, grpE, dnaK, fepB, dnaJ, rpoD, lon*	Denaturation, misfolding, cross-linking and alkylation of proteins, oxidation of individual amino acids and protein damage.
Drug resistance		*yedW, dacA, dacB, marR, sbmA, bacA, yhjX, emrE, sanA, emrA, marC, mdtK, yajR, fsr, cmr, mrcB, pbpG, ssrA, ompC, amiC, clsA*	Related to compound /chemical induced stress, membrane transporter and efflux pump
Cell killing		*dinJ, slyA, yeeV, yfjG, relB*	Related to the killing of own cells or another organism
General stress	**Cold shock**	*cspA, cspB*	Temperature downshift
	General Stress	*uspA, otsB, ydgL, bolA, rpoE, sdhC, cyoA*	Disturbance of the biochemical and biophysical homeostasis of the cell.
	General function	*phoB, crp, cdaR, ydeO, ybgI, gadX*	Disturbance of the biochemical and biophysical homeostasis of the cell.

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44

45 Table S2. Model chemicals analyzed in this study and known toxicity mechanisms reported

Chemicals	Symbols	Concentrations	Suggested possible mechanisms of toxicity	Manufacturers
mitomycin	MMC	5 ng/L, 50 ng/L, 500 ng/L, 5 μg/L, 50 μg/L, 500 μg/L	DNA damage[2]	Research Products International, IL
hydrogen peroxide	H_2O_2	2.5 mg/L, 5 mg/L, 10 mg/L, 20 mg/L, 40 mg/L, 80 mg/L	redox stresses, general stresses[3]	Sigma-Aldrich, MO
lead nitrate	Pb^{2+}	0.125 μg/L, 1.25 μg/L, 12.5 μg/L, 125 μg/L, 1.25 mg/L, 12.5 mg/L	Redox stresses, drug resistance, membrane protein stresses, DNA damage[4-7]	Acros Organics, NJ

46 Chemical preparation: The chemicals used are analytic grade and are prepared using growth

47 media (M9) before adding to micro plates. The chemicals are distributed using BioTek precision

48 automated pipetting system.

49

Table S3. Repeated measures ANOVA test on the impacts of concentration and time factors on the gene expression levels (chemical: MMC)[1]

	Degree of freedom	Sum of squares	Mean sum of squares	F value	Significance
Concentration	5	66	13.110	4.788	0.000224
Time	24	178	7.428	2.713	1.19×10^{-5}
Interaction	120	135	1.128	0.412	1
Residual	48127	131790	2.738		

[1]. Conducted using R (version 3.1.2).

Table S4. Repeated measures ANOVA test on the impacts of concentration and time factors on the gene expression levels (chemical: H_2O_2)[1]

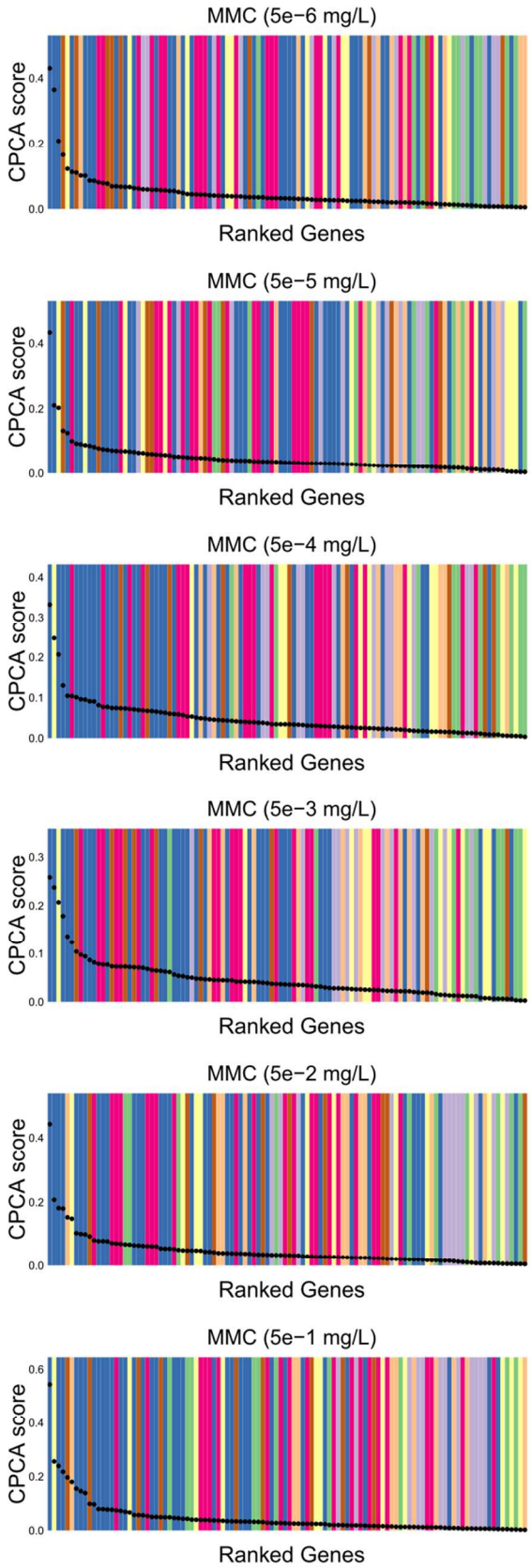
	Degree of freedom	Sum of squares	Mean sum of squares	F value	Significance
Concentration	5	50	10.098	23.759	$< 2\times10^{-16}$
Time	24	176	7.336	17.259	$< 2\times10^{-16}$
Interaction	120	83	0.696	1.637	1.39×10^{-5}
Residual	48127	20456	0.425		

[1]. Conducted using R (version 3.1.2).

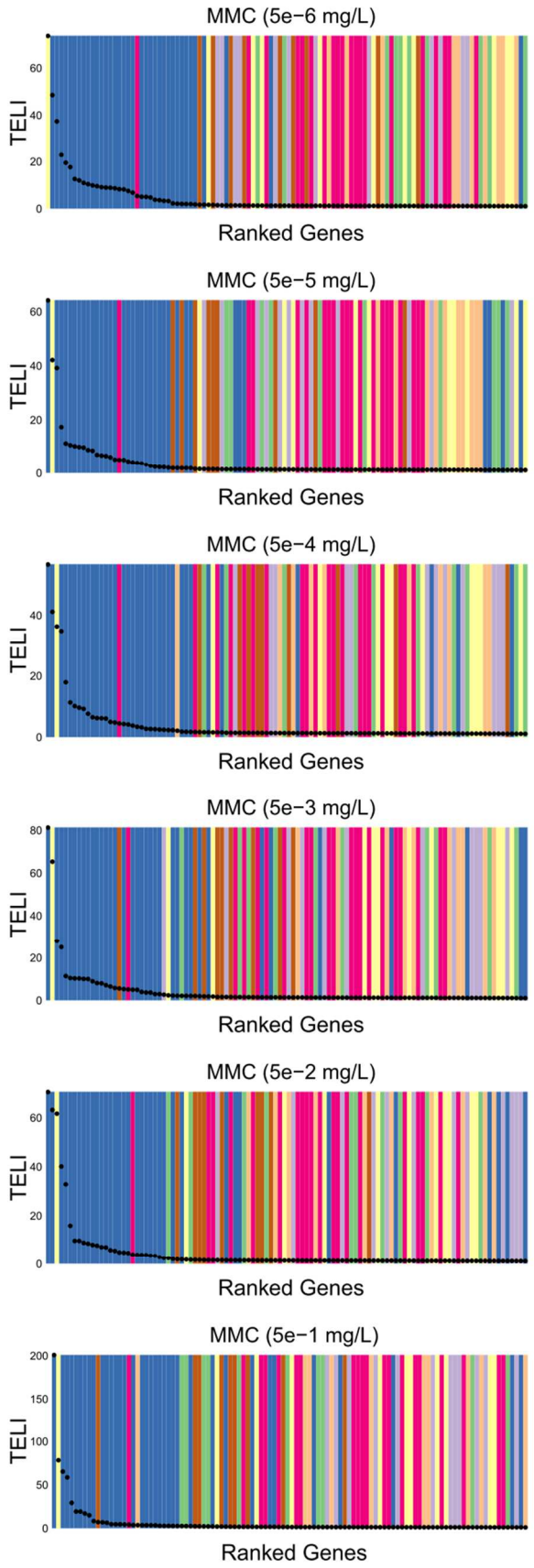
Table S5. Repeated measures ANOVA test on the impacts of concentration and time factors on the gene expression levels (chemical: Pb^{2+})[1]

	Degree of freedom	Sum of squares	Mean sum of squares	F value	Significance
Concentration	5	126	25.28	8.949	1.65×10^{-8}
Time	24	1385	57.72	20.434	$< 2\times10^{-16}$
Interaction	120	59	0.49	0.175	1
Residual	48127	135954	2.82		

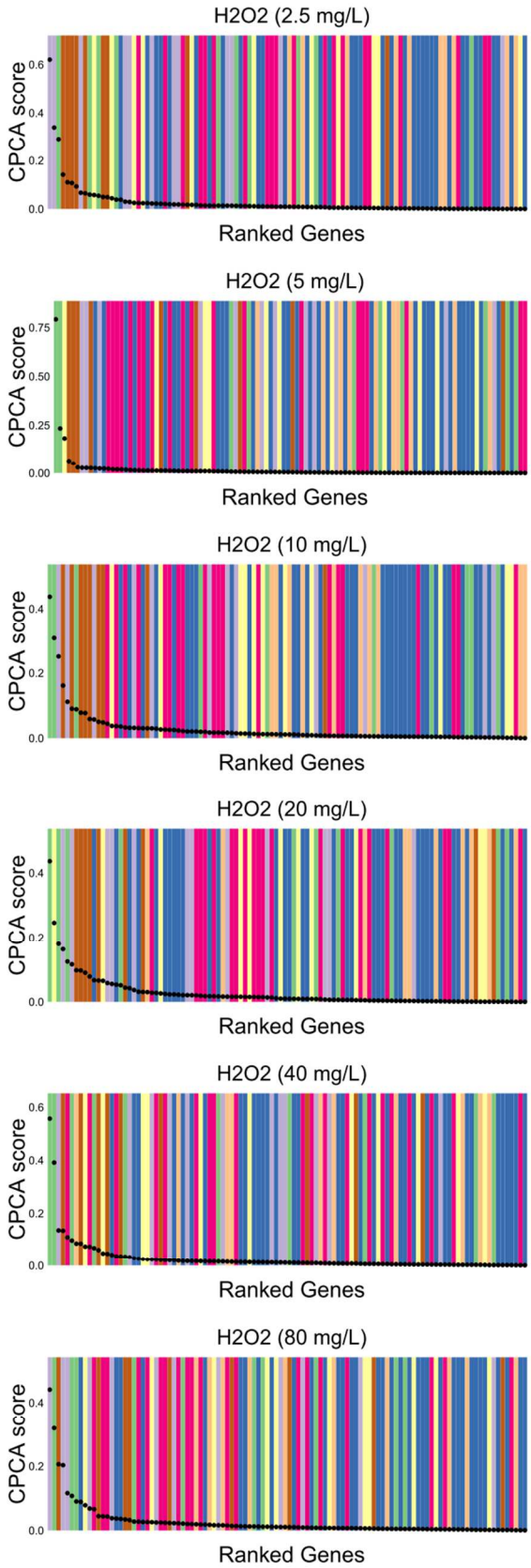
[1]. Conducted using R (version 3.1.2).


MMC (5e−6 mg/L)
CPCA score
0.0
0.2
0.4
Ranked Genes
MMC (5e−5 mg/L)
CPCA score
0.0
0.2
0.4
Ranked Genes
MMC (5e−4 mg/L)
CPCA score
0.0
0.1
0.2
0.3
0.4
Ranked Genes
MMC (5e−3 mg/L)
CPCA score
0.0
0.1
0.2
0.3
Ranked Genes
MMC (5e−2 mg/L)
CPCA score
0.0
0.2
0.4
Ranked Genes
MMC (5e−1 mg/L)
CPCA score
0.0
0.2
0.4
0.6
Ranked Genes

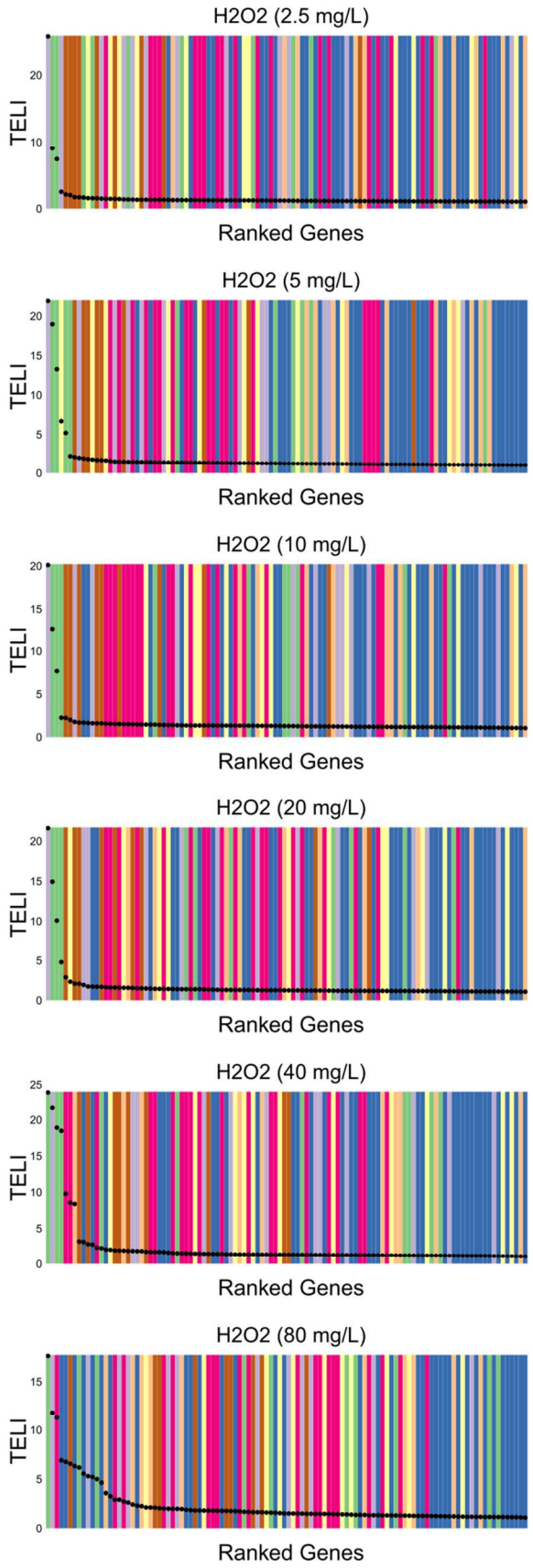
61 (a)


MMC (5e−6 mg/L)
TELI
Ranked Genes
MMC (5e−5 mg/L)
TELI
Ranked Genes
MMC (5e−4 mg/L)
TELI
Ranked Genes
MMC (5e−3 mg/L)
TELI
Ranked Genes
MMC (5e−2 mg/L)
TELI
Ranked Genes
MMC (5e−1 mg/L)
TELI
Ranked Genes

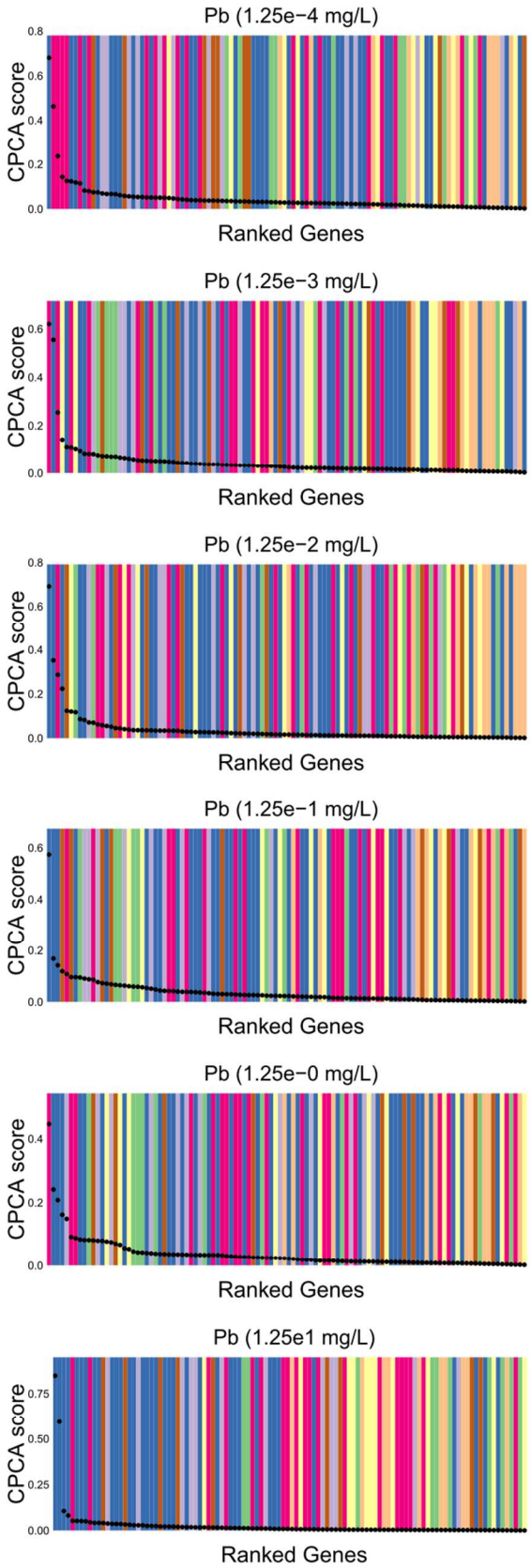
62 (b)


H2O2 (2.5 mg/L)
CPCA score
0.6
0.4
0.2
0.0
Ranked Genes
H2O2 (5 mg/L)
CPCA score
0.75
0.50
0.25
0.00
Ranked Genes
H2O2 (10 mg/L)
CPCA score
0.4
0.2
0.0
Ranked Genes
H2O2 (20 mg/L)
CPCA score
0.4
0.2
0.0
Ranked Genes
H2O2 (40 mg/L)
CPCA score
0.6
0.4
0.2
0.0
Ranked Genes
H2O2 (80 mg/L)
CPCA score
0.4
0.2
0.0
Ranked Genes

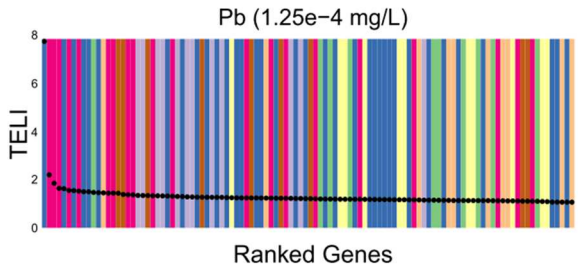
63 (c)

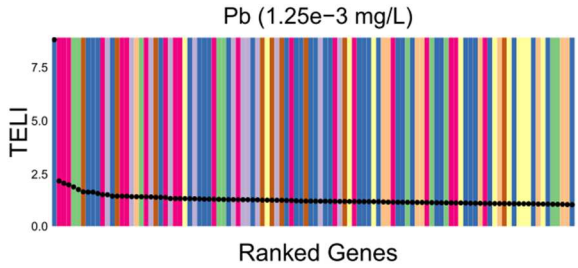

H2O2 (2.5 mg/L)
TELI
Ranked Genes
H2O2 (5 mg/L)
TELI
Ranked Genes
H2O2 (10 mg/L)
TELI
Ranked Genes
H2O2 (20 mg/L)
TELI
Ranked Genes
H2O2 (40 mg/L)
TELI
Ranked Genes
H2O2 (80 mg/L)
TELI
Ranked Genes

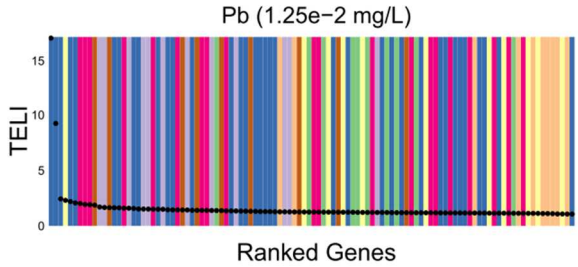
64 (d)

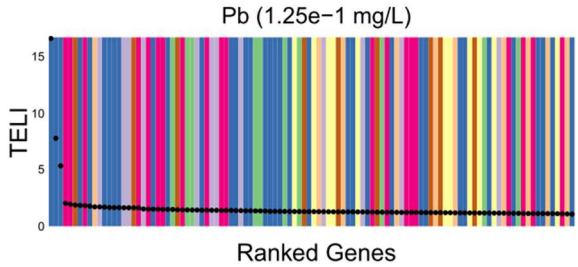

Pb (1.25e−4 mg/L)
CPCA score
Ranked Genes
Pb (1.25e−3 mg/L)
CPCA score
Ranked Genes
Pb (1.25e−2 mg/L)
CPCA score
Ranked Genes
Pb (1.25e−1 mg/L)
CPCA score
Ranked Genes
Pb (1.25e−0 mg/L)
CPCA score
Ranked Genes
Pb (1.25e1 mg/L)
CPCA score
Ranked Genes

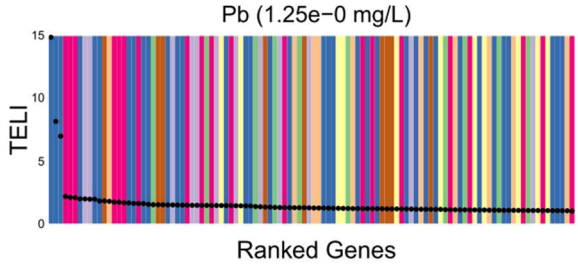
65 (e)

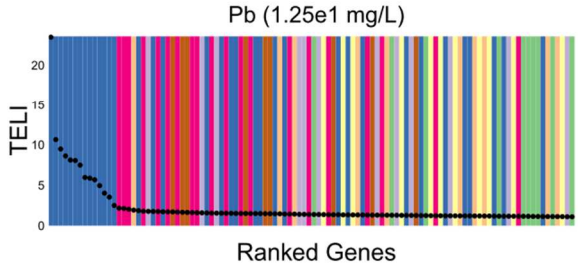

Pb (1.25e−4 mg/L)
TELI
Ranked Genes


Pb (1.25e−3 mg/L)
TELI
Ranked Genes


Pb (1.25e−2 mg/L)
TELI
Ranked Genes

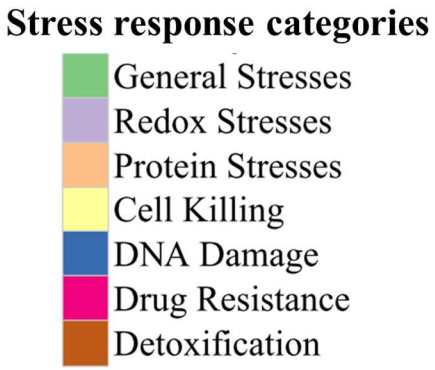

Pb (1.25e−1 mg/L)
TELI
Ranked Genes


Pb (1.25e−0 mg/L)
TELI
Ranked Genes


Pb (1.25e1 mg/L)
TELI
Ranked Genes

66 (f)

67



68

69 (g) Colors indicting pathways used in the figures above.

70

71 Figure S1. The GSEA analysis gene ranking results (triplicate treatments) from 3 chemicals at
72 six dose concentration, low to high from top to bottom, respectively: (a) MMC (CPCA score),
73 (b) MMC (TELI), (c) H_2O_2 (CPCA score), (d) H_2O_2 (TELI), (e) Pb^{2+} (CPCA score), and (f) Pb^{2+}
74 (TELI). The color codes for each stress response categories or pathways labels are shown in (g).

Table S6. GSEA ranking results for MMC (0.5 μg/L) based on CPCA score.

rank	name	score	pathway	rank	name	score	pathway	rank	name	score	pathway	rank	name	score	pathway
1	recX	0.332	DNA	28	fpr	0.060	detox	55	uspB	0.034	detox	82	ydeO	0.019	cellkilling
2	ybgL	0.247	cellkilling	29	polB	0.059	DNA	56	dnaQ	0.034	DNA	83	inaA	0.018	redox
3	ada	0.207	DNA	30	cls	0.059	drug	57	sodA	0.033	redox	84	sdhC	0.017	general
4	recE	0.130	DNA	31	yajR	0.057	drug	58	dps	0.032	redox	85	clpB	0.017	DNA
5	yjiW	0.104	DNA	32	bacA	0.053	drug	59	mutM	0.031	DNA	86	uvrD	0.017	DNA
6	fsr	0.104	drug	33	dinJ	0.053	cellkilling	60	ykfG	0.031	DNA	87	cdaR	0.016	cellkilling
7	yafN	0.101	DNA	34	ftsk	0.051	DNA	61	mdtK	0.031	drug	88	relB	0.016	cellkilling
8	polA	0.096	DNA	35	entC	0.049	protein	62	yhjX	0.030	drug	89	clpB	0.016	protein
9	mutT	0.095	DNA	36	sbmC	0.048	DNA	63	sbmA	0.029	drug	90	fepB	0.015	protein
10	dinG	0.091	DNA	37	sodB	0.047	redox	64	pbpG	0.029	drug	91	zntA	0.015	detox
11	mutS	0.091	DNA	38	grpE	0.046	protein	65	ahpF	0.028	redox	92	otsB	0.015	general
12	mha	0.082	DNA	39	sulA	0.045	DNA	66	dinB	0.028	DNA	93	bolA	0.013	general
13	yedW	0.077	drug	40	norR	0.044	detox	67	cueR	0.027	protein	94	cmr	0.013	drug
14	recA	0.077	DNA	41	lexA	0.043	DNA	68	yeiG	0.027	detox	95	soxS	0.013	redox
15	uvrR	0.074	DNA	42	cspB	0.043	general	69	uvrA	0.026	DNA	96	soxR	0.012	redox
16	mutY	0.074	DNA	43	dnaK	0.042	protein	70	marR	0.026	drug	97	dacA	0.012	drug
17	yeaE	0.074	detox	44	recN	0.041	DNA	71	yeeV	0.025	cellkilling	98	cspA	0.011	general
18	ybfE	0.073	DNA	45	emrE	0.040	drug	72	marC	0.025	drug	99	gst	0.010	detox
19	emrA	0.072	drug	46	mrcB	0.039	drug	73	yfjG	0.025	cellkilling	100	ruvA	0.009	DNA
20	yebG	0.071	DNA	47	ssrA	0.039	drug	74	oxyR	0.024	redox	101	yniC	0.009	detox
21	mug	0.069	DNA	48	rnt	0.038	DNA	75	ycgE	0.023	protein	102	phoB	0.009	general
22	sanA	0.069	drug	49	katG	0.038	redox	76	ssb	0.023	DNA	103	ompC	0.007	cellkilling
23	tam	0.067	detox	50	ahpC	0.037	redox	77	katE	0.023	redox	104	rpoD	0.006	protein
24	uvrC	0.067	DNA	51	dacB	0.034	drug	78	sodC	0.022	redox	105	cyoA	0.006	general
25	nfo	0.065	DNA	52	uspA	0.034	general	79	lon	0.022	protein	106	crp	0.005	cellkilling
26	mutH	0.064	DNA	53	gadX	0.034	cellkilling	80	dnaJ	0.021	protein	107	rpoE	0.005	general
27	umuD	0.063	DNA	54	slyA	0.034	cellkilling	81	amiC	0.020	drug	108	ydgL	0.003	general

Table S7. GSEA ranking results for MMC (0.5 μg/L) based on TELI

rank	name	score	pathway	rank	name	score	pathway	rank	name	score	pathway	rank	name	score	pathway
1	dinG	56.57	DNA	28	clpB	2.31	DNA	55	yeaE	1.33	detox	82	cueR	1.20	protein
2	umuD	41.15	DNA	29	yebG	2.29	DNA	56	entC	1.33	protein	83	dacA	1.20	drug
3	ybgL	35.93	cellkilling	30	dnaK	2.10	protein	57	mutH	1.33	DNA	84	rpoE	1.20	general
4	mha	34.42	DNA	31	polB	1.81	DNA	58	marC	1.33	drug	85	slyA	1.20	cellkilling
5	recX	17.90	DNA	32	uvrD	1.75	DNA	59	sbmA	1.32	drug	86	dps	1.20	redox
6	recA	11.30	DNA	33	sulA	1.72	DNA	60	fepB	1.31	protein	87	uvrA	1.19	DNA
7	ybfE	10.13	DNA	34	ssrA	1.67	drug	61	yhjX	1.30	drug	88	katE	1.19	redox
8	mug	9.60	DNA	35	tam	1.64	detox	62	dinJ	1.30	cellkilling	89	lon	1.18	protein
9	mutT	9.21	DNA	36	uspA	1.61	general	63	grpE	1.29	protein	90	soxS	1.18	redox
10	rnt	7.63	DNA	37	uvrC	1.60	DNA	64	amiC	1.29	drug	91	clpB	1.18	protein
11	yafN	6.49	DNA	38	cdaR	1.57	cellkilling	65	marR	1.29	drug	92	phoB	1.18	general
12	ykfG	6.21	DNA	39	sanA	1.57	drug	66	zntA	1.28	detox	93	ssb	1.17	DNA
13	recN	6.15	DNA	40	nfo	1.54	DNA	67	mdtK	1.28	drug	94	soxR	1.17	redox
14	ada	6.06	DNA	41	ydgL	1.43	general	68	sodB	1.28	redox	95	cspB	1.16	general
15	yjiW	4.97	DNA	42	bacA	1.43	drug	69	ahpC	1.27	redox	96	yeeV	1.16	cellkilling
16	ftsk	4.77	DNA	43	katG	1.42	redox	70	otsB	1.26	general	97	ydeO	1.16	cellkilling
17	yedW	4.44	drug	44	fpr	1.41	detox	71	cmr	1.26	drug	98	relB	1.15	cellkilling
18	sbmC	4.28	DNA	45	mrcB	1.41	drug	72	emrE	1.26	drug	99	ycgE	1.15	protein
19	uvrR	4.12	DNA	46	norR	1.41	detox	73	yajR	1.25	drug	100	rpoD	1.15	protein
20	dnaQ	3.77	DNA	47	cls	1.40	drug	74	sdhC	1.25	general	101	oxyR	1.15	redox
21	mutY	3.38	DNA	48	yniC	1.39	detox	75	yfjG	1.25	cellkilling	102	inaA	1.14	redox
22	ruvA	3.19	DNA	49	yeiG	1.39	detox	76	dacB	1.25	drug	103	sodC	1.13	redox
23	recE	2.72	DNA	50	emrA	1.36	drug	77	gadX	1.23	cellkilling	104	gst	1.13	detox
24	mutM	2.66	DNA	51	ahpF	1.35	redox	78	ompC	1.23	cellkilling	105	dinB	1.12	DNA
25	mutS	2.61	DNA	52	sodA	1.35	redox	79	uspB	1.22	detox	106	cyoA	1.12	general
26	polA	2.48	DNA	53	dnaJ	1.34	protein	80	pbpG	1.22	drug	107	crp	1.10	cellkilling
27	lexA	2.41	DNA	54	bolA	1.34	general	81	fsr	1.21	drug	108	cspA	1.10	general

Table S8. GSEA ranking results for H_2O_2 (10mg/L) based on CPCA score.

rank	name	score	pathway	rank	name	score	pathway	rank	name	score	pathway	rank	name	score	pathway
1	rpoE	0.437	general	28	sbmA	0.026	drug	55	ycgE	0.011	protein	82	dnaQ	0.005	DNA
2	phoB	0.307	general	29	lexA	0.025	DNA	56	umuD	0.011	DNA	83	yafN	0.005	DNA
3	sodB	0.251	redox	30	marR	0.023	drug	57	rnt	0.011	DNA	84	pbpG	0.005	drug
4	zntA	0.161	detox	31	cls	0.022	drug	58	fepB	0.010	protein	85	ykfG	0.005	DNA
5	sodA	0.112	redox	32	nfo	0.021	DNA	59	recN	0.009	DNA	86	recX	0.005	DNA
6	uspB	0.090	detox	33	polB	0.021	DNA	60	crp	0.009	cellkilling	87	ydgL	0.004	general
7	bolA	0.089	general	34	dinB	0.020	DNA	61	inaA	0.008	redox	88	uvrR	0.004	DNA
8	norR	0.078	detox	35	cspA	0.020	general	62	ftsk	0.008	DNA	89	yeeV	0.004	cellkilling
9	fpr	0.077	detox	36	yhjX	0.019	drug	63	yeaE	0.008	detox	90	sbmC	0.004	DNA
10	tam	0.059	detox	37	ahpC	0.017	redox	64	mrcB	0.008	drug	91	uvrD	0.004	DNA
11	katG	0.057	redox	38	emrE	0.017	drug	65	dnaK	0.007	protein	92	ssrA	0.003	drug
12	yeiG	0.050	detox	39	dacA	0.017	drug	66	cmr	0.007	drug	93	marC	0.003	drug
13	gst	0.048	detox	40	sanA	0.017	drug	67	mdtK	0.007	drug	94	dinG	0.003	DNA
14	amiC	0.044	drug	41	soxR	0.017	redox	68	sulA	0.007	DNA	95	cspB	0.003	general
15	cdaR	0.038	cellkilling	42	yjiW	0.016	DNA	69	uvrC	0.007	DNA	96	cyoA	0.003	general
16	emrA	0.037	drug	43	ahpF	0.015	redox	70	mutY	0.007	DNA	97	mug	0.003	DNA
17	ybfE	0.036	DNA	44	ydeO	0.014	cellkilling	71	clpB	0.006	protein	98	mutM	0.003	DNA
18	yedW	0.033	drug	45	slyA	0.014	cellkilling	72	oxyR	0.006	redox	99	soxS	0.002	redox
19	ada	0.032	DNA	46	recE	0.014	DNA	73	cueR	0.006	protein	100	mutT	0.002	DNA
20	sodC	0.032	redox	47	gadX	0.013	cellkilling	74	otsB	0.006	general	101	dps	0.002	redox
21	dacB	0.031	drug	48	yajR	0.012	drug	75	dnaJ	0.006	protein	102	sdhC	0.002	general
22	recA	0.030	DNA	49	ompC	0.012	cellkilling	76	ruvA	0.005	DNA	103	mutS	0.002	DNA
23	yniC	0.030	detox	50	uspA	0.012	general	77	clpB	0.005	DNA	104	ybgL	0.001	cellkilling
24	katE	0.030	redox	51	rpoD	0.012	protein	78	ssb	0.005	DNA	105	dinJ	0.001	cellkilling
25	yebG	0.029	DNA	52	grpE	0.012	protein	79	mutH	0.005	DNA	106	fsr	0.001	drug
26	relB	0.027	cellkilling	53	uvrA	0.012	DNA	80	polA	0.005	DNA	107	entC	0.000	protein
27	bacA	0.026	drug	54	yfjG	0.011	cellkilling	81	mha	0.005	DNA	108	lon	0.000	protein

Table S9. GSEA ranking results for H_2O_2 (10mg/L) based on TELI.

rank	name	score	pathway	rank	name	score	pathway	rank	name	score	pathway	rank	name	score	pathway
1	zntA	11.78	detox	28	dacB	1.93	drug	55	slyA	1.41	cellkilling	81	sdhC	1.18	general
2	umuD	4.71	DNA	29	uspB	1.92	redox	56	ycgE	1.41	protein	82	grpE	1.16	protein
3	recN	4.14	DNA	30	recA	1.88	DNA	57	fsr	1.41	drug	83	yhjX	1.16	drug
4	nfo	3.54	DNA	31	entC	1.81	protein	58	sanA	1.39	drug	84	polA	1.14	DNA
5	uvrY	3.06	DNA	32	uvrC	1.79	DNA	59	ytfE	1.37	redox	85	ftsk	1.12	DNA
6	flgM	3.04	detox	33	uvrD	1.78	DNA	60	ada	1.37	DNA	86	yafN	1.11	DNA
7	ompC	2.94	cellkilling	34	gadX	1.78	cellkilling	61	fepB	1.36	protein	87	mutT	1.1	DNA
8	dacA	2.75	drug	35	ahpC	1.74	redox	62	clpB	1.33	DNA	88	grxA	1.09	DNA
9	tam	2.66	detox	36	ybfE	1.69	DNA	63	pbpG	1.32	drug	89	uvrA	1.08	DNA
10	sodB	2.61	redox	37	cueR	1.69	protein	64	yjiW	1.31	DNA	90	dinB	1.08	DNA
11	ydeO	2.53	cellkilling	38	cspB	1.64	general	65	bacA	1.3	drug	91	mutS	1.07	DNA
12	yedW	2.51	drug	39	sbmC	1.64	DNA	66	cmr	1.29	drug	92	soxS	1.06	redox
13	phoB	2.48	general	40	dps	1.63	redox	67	gst	1.25	detox	93	cls	1.05	drug
14	sodC	2.45	redox	41	bolA	1.63	general	68	yeaE	1.25	detox	94	marR	1.05	drug
15	lexA	2.44	DNA	42	katE	1.57	redox	69	rpoE	1.25	general	95	ykfG	1.05	DNA
16	dinG	2.25	DNA	43	uspA	1.57	general	70	norR	1.25	detox	96	rnt	1.05	DNA
17	katG	2.22	redox	44	amiC	1.57	drug	71	dnaK	1.24	protein	97	yajR	1.04	drug
18	oxyR	2.19	redox	45	dinJ	1.56	cellkilling	72	rpoD	1.24	protein	98	recX	1.03	DNA
19	lon	2.16	protein	46	polB	1.55	DNA	73	yeeV	1.23	cellkilling	99	sulA	1	DNA
20	fpr	2.15	detox	47	inaA	1.53	redox	74	cyoA	1.23	general	100	yebG	1	DNA
21	ruvA	2.1	DNA	48	ahpF	1.51	redox	75	cspA	1.21	general	101	mutH	1	DNA
22	dnaQ	2.05	DNA	49	yeiG	1.49	detox	76	mutY	1.2	DNA	102	recE	1	DNA
23	relB	2.04	cellkilling	50	crp	1.47	cellkilling	77	mug	1.2	DNA	103	sbmA	1	drug
24	yfjG	2.03	cellkilling	51	emrE	1.46	drug	78	ssb	1.2	DNA	104	emrA	1	drug
25	motA	2.03	detox	52	soxR	1.44	redox	79	mutM	1.2	DNA	105	marC	1	drug
26	sodA	1.99	redox	53	otsB	1.43	general	80	ydgL	1.19	general	106	mdtK	1	drug
27	dnaJ	1.95	protein	54	ssrA	1.42	drug	81	sdhC	1.18	general	107	mrcB	1	drug

Table S10. GSEA ranking results for Pb^{2+} (0.125 μg/L) based on CPCA score

rank	name	score	pathway	rank	name	score	pathway	rank	name	score	pathway	rank	name	score	pathway
1	yebG	0.680	DNA	28	yfjG	0.049	cellkilling	55	sulA	0.028	DNA	82	dnaJ	0.016	protein
2	sbmA	0.463	drug	29	ahpF	0.047	redox	56	fsr	0.028	drug	83	ompC	0.015	cellkilling
3	emrA	0.235	drug	30	cls	0.044	drug	57	crp	0.027	cellkilling	84	soxS	0.015	redox
4	mdtK	0.143	drug	31	uvrA	0.042	DNA	58	sbmC	0.027	DNA	85	ybgL	0.014	cellkilling
5	bacA	0.125	drug	32	yedW	0.041	drug	59	sanA	0.027	drug	86	mutS	0.014	DNA
6	polA	0.123	DNA	33	mutT	0.039	DNA	60	grpE	0.026	protein	87	recN	0.013	DNA
7	recE	0.118	DNA	34	rnt	0.039	DNA	61	ssb	0.026	DNA	88	cdaR	0.012	cellkilling
8	dacB	0.114	drug	35	ssrA	0.038	drug	62	mrcB	0.026	drug	89	zntA	0.012	detox
9	yjiW	0.082	DNA	36	yeaE	0.037	detox	63	dnaQ	0.026	DNA	90	rpoE	0.011	general
10	marR	0.079	drug	37	ahpC	0.037	redox	64	nfo	0.025	DNA	91	entC	0.011	protein
11	fpr	0.074	detox	38	yniC	0.037	detox	65	phoB	0.025	general	92	yeeV	0.010	cellkilling
12	mutH	0.074	DNA	39	norR	0.037	detox	66	uvrD	0.024	DNA	93	fepB	0.010	protein
13	oxyR	0.069	redox	40	dps	0.036	redox	67	ybfE	0.024	DNA	94	dacA	0.010	drug
14	katG	0.067	redox	41	ydgL	0.035	general	68	sodB	0.023	redox	95	sdhC	0.009	general
15	recX	0.067	DNA	42	gadX	0.035	cellkilling	69	dinB	0.022	DNA	96	dinJ	0.008	cellkilling
16	yafN	0.066	DNA	43	lexA	0.034	DNA	70	sodC	0.022	redox	97	cyoA	0.008	general
17	mha	0.061	DNA	44	cspA	0.034	general	71	uvrR	0.022	DNA	98	amiC	0.008	drug
18	uspB	0.058	detox	45	yeiG	0.033	detox	72	umuD	0.021	DNA	99	clpB	0.007	DNA
19	sodA	0.056	redox	46	tam	0.033	detox	73	emrE	0.021	drug	100	clpB	0.006	protein
20	ftsk	0.054	DNA	47	ykfG	0.032	DNA	74	ycgE	0.021	protein	101	rpoD	0.006	protein
21	inaA	0.053	redox	48	ada	0.031	DNA	75	slyA	0.020	cellkilling	102	cueR	0.005	protein
22	mutM	0.053	DNA	49	uvrC	0.031	DNA	76	marC	0.020	drug	103	soxR	0.005	redox
23	yhjX	0.051	drug	50	ruvA	0.031	DNA	77	dinG	0.019	DNA	104	recA	0.005	DNA
24	mug	0.051	DNA	51	uspA	0.030	general	78	polB	0.019	DNA	105	lon	0.004	protein
25	yajR	0.050	drug	52	cspB	0.030	general	79	pbpG	0.018	drug	106	ydeO	0.004	cellkilling
26	katE	0.050	redox	53	dnaK	0.029	protein	80	bolA	0.018	general	107	mutY	0.004	DNA
27	cmr	0.049	drug	54	relB	0.028	cellkilling	81	otsB	0.016	general	108	gst	0.002	detox

Table S11. GSEA ranking results for Pb^{2+} (0.125 μg/L) based on TELI

rank	name	score	pathway	rank	name	score	pathway	rank	name	score	pathway	rank	name	score	pathway
1	motA	5.47	detox	28	sanA	1.77	drug	55	grpE	1.51	protein	81	mutS	1.26	DNA
2	soxS	5.19	redox	29	ssrA	1.76	drug	56	umuD	1.49	DNA	82	uvrD	1.24	DNA
3	fpr	4.99	detox	30	yeiG	1.75	detox	57	yhjX	1.49	drug	83	grxA	1.23	DNA
4	marC	3.28	drug	31	dacA	1.7	drug	58	polB	1.49	DNA	84	rpoD	1.23	protein
5	ahpF	3.15	redox	32	uvrC	1.68	DNA	59	mutY	1.48	DNA	85	cspA	1.22	general
6	cyoA	3.02	general	33	lexA	1.66	DNA	60	emrA	1.47	drug	86	rnt	1.21	DNA
7	katG	2.94	redox	34	yeeV	1.65	cellkilling	61	sbmA	1.46	drug	87	recX	1.21	DNA
8	yajR	2.88	drug	35	dinJ	1.63	cellkilling	62	nfo	1.46	DNA	88	norR	1.2	detox
9	oxyR	2.76	redox	36	recE	1.63	DNA	63	amiC	1.45	drug	89	cls	1.2	drug
10	ruvA	2.73	DNA	37	fepB	1.61	protein	64	dinB	1.43	DNA	90	clpB	1.19	DNA
11	zntA	2.52	detox	38	dnaQ	1.6	DNA	65	uspA	1.42	general	91	entC	1.18	protein
12	mug	2.26	DNA	39	pbpG	1.59	drug	66	yafN	1.42	DNA	92	uvrA	1.18	DNA
13	lon	2.26	protein	40	mdtK	1.59	drug	67	ycgE	1.41	protein	93	rpoE	1.16	general
14	katE	2.25	redox	41	mutT	1.58	DNA	68	sodA	1.41	redox	94	recA	1.14	DNA
15	sodC	2.23	redox	42	ydgL	1.57	general	69	gst	1.4	detox	95	uspB	1.14	redox
16	recN	2.23	DNA	43	slyA	1.57	cellkilling	70	crp	1.39	cellkilling	96	dps	1.13	redox
17	gadX	2.19	cellkilling	44	cspB	1.56	general	71	mrcB	1.38	drug	97	yjiW	1.12	DNA
18	emrE	1.97	drug	45	cueR	1.56	protein	72	marR	1.37	drug	98	bolA	1.12	general
19	relB	1.95	cellkilling	46	otsB	1.55	general	73	mutH	1.37	DNA	99	mutM	1.1	DNA
20	yedW	1.93	drug	47	sdhC	1.55	general	74	cmr	1.37	drug	100	polA	1.09	DNA
21	ydeO	1.92	cellkilling	48	ada	1.55	DNA	75	yeaE	1.33	detox	101	ssb	1.08	DNA
22	fsr	1.91	drug	49	ybfE	1.54	DNA	76	flgM	1.31	detox	102	sulA	1.07	DNA
23	dnaJ	1.87	protein	50	dacB	1.53	drug	77	ompC	1.3	cellkilling	103	ykfG	1.06	DNA
24	sbmC	1.82	DNA	51	ahpC	1.53	redox	78	yebG	1.3	DNA	104	ytfE	1.04	redox
25	ftsk	1.81	DNA	52	yfjG	1.51	cellkilling	79	inaA	1.29	redox	105	sodB	1.04	redox
26	bacA	1.79	drug	53	dnaK	1.51	protein	80	dinG	1.27	DNA	106	tam	1	detox
27	soxR	1.78	redox	54	uvrY	1.51	DNA	81	mutS	1.26	DNA	107	phoB	1	general

Table S12. GSEA ranking results for MMC (6 concenrtations) based on CPCA score

rank	name	score	pathway	rank	name	score	pathway	rank	name	score	pathway	rank	name	score	pathway
1	recX	0.646	DNA	28	uvrC	0.049	DNA	55	yebG	0.031	DNA	82	bolA	0.020	general
2	ada	0.255	DNA	29	sulA	0.048	DNA	56	uvrD	0.030	DNA	83	zntA	0.019	detox
3	ybgL	0.177	cellkilling	30	sbmA	0.048	drug	57	ydeO	0.030	cellkilling	84	fepB	0.018	protein
4	polA	0.173	DNA	31	rnt	0.047	DNA	58	recN	0.029	DNA	85	dnaQ	0.018	DNA
5	recE	0.166	DNA	32	yfjG	0.046	cellkilling	59	yeiG	0.029	detox	86	umuD	0.016	DNA
6	yafN	0.098	DNA	33	recA	0.045	DNA	60	amiC	0.028	drug	87	clpB	0.016	DNA
7	mutT	0.095	DNA	34	cdaR	0.045	cellkilling	61	mdtK	0.027	drug	88	clpB	0.016	protein
8	tam	0.090	detox	35	mutH	0.044	DNA	62	phoB	0.027	general	89	dps	0.015	redox
9	uspB	0.088	detox	36	emrE	0.041	drug	63	yhjX	0.027	drug	90	uvrA	0.015	DNA
10	emrA	0.085	drug	37	sodB	0.040	redox	64	relB	0.026	cellkilling	91	katE	0.014	redox
11	ybfE	0.080	DNA	38	dnaK	0.040	protein	65	gadX	0.026	cellkilling	92	gst	0.014	detox
12	mutS	0.077	DNA	39	ssrA	0.039	drug	66	sodC	0.026	redox	93	soxR	0.013	redox
13	yeaE	0.074	detox	40	katG	0.039	redox	67	dinB	0.026	DNA	94	otsB	0.012	general
14	fsr	0.069	drug	41	cmr	0.039	drug	68	cueR	0.025	protein	95	slyA	0.012	cellkilling
15	dinG	0.069	DNA	42	pbpG	0.039	drug	69	dacA	0.025	drug	96	rpoD	0.010	protein
16	yjiW	0.067	DNA	43	marR	0.038	drug	70	dnaJ	0.025	protein	97	inaA	0.009	redox
17	fpr	0.065	detox	44	yajR	0.038	drug	71	yniC	0.025	detox	98	rpoE	0.009	general
18	norR	0.064	detox	45	marC	0.038	drug	72	mutM	0.025	DNA	99	soxS	0.008	redox
19	mha	0.064	DNA	46	mrcB	0.037	drug	73	ahpF	0.024	redox	100	ydgL	0.008	general
20	uvrR	0.060	DNA	47	lon	0.037	protein	74	yeeV	0.023	cellkilling	101	dinJ	0.007	cellkilling
21	polB	0.058	DNA	48	grpE	0.036	protein	75	uspA	0.023	general	102	crp	0.007	cellkilling
22	nfo	0.057	DNA	49	sodA	0.035	redox	76	lexA	0.023	DNA	103	oxyR	0.006	redox
23	bacA	0.056	drug	50	sbmC	0.034	DNA	77	sanA	0.023	drug	104	cspB	0.006	general
24	cls	0.052	drug	51	entC	0.034	protein	78	sdhC	0.022	general	105	ompC	0.005	cellkilling
25	ftsk	0.050	DNA	52	ykfG	0.034	DNA	79	ycgE	0.022	protein	106	cspA	0.004	general
26	mug	0.050	DNA	53	ahpC	0.033	redox	80	ssb	0.022	DNA	107	cyoA	0.003	general
27	yedW	0.050	drug	54	dacB	0.031	drug	81	mutY	0.021	DNA	108	ruvA	0.002	DNA

Table S13. GSEA ranking results for MMC (six concentrations) based on TELI.

rank	name	score	pathway	rank	name	score	pathway	rank	name	score	pathway	rank	name	score	pathway
1	ybgL	59.48	cellkilling	28	norR	3.24	detox	55	rpoE	1.40	general	82	sbmA	1.24	drug
2	dinG	55.74	DNA	29	yebG	3.11	DNA	56	uspB	1.40	detox	83	crp	1.23	cellkilling
3	recA	52.39	DNA	30	ruvA	2.97	DNA	57	mrcB	1.39	drug	84	mdtK	1.22	drug
4	umuD	24.59	DNA	31	mutS	2.83	DNA	58	katG	1.36	redox	85	oxyR	1.22	redox
5	mha	18.79	DNA	32	sulA	2.29	DNA	59	uvrD	1.36	DNA	86	fepB	1.22	protein
6	recX	17.84	DNA	33	uvrC	1.93	DNA	60	dnaK	1.36	protein	87	gadX	1.21	cellkilling
7	rnt	15.53	DNA	34	nfo	1.79	DNA	61	cls	1.34	drug	88	relB	1.21	cellkilling
8	ykfG	14.95	DNA	35	lexA	1.76	DNA	62	uvrA	1.33	DNA	89	grpE	1.20	protein
9	dnaQ	11.00	DNA	36	yniC	1.76	detox	63	ahpC	1.32	redox	90	yeeV	1.20	cellkilling
10	mutT	10.18	DNA	37	dinB	1.74	DNA	64	yhjX	1.31	drug	91	sodC	1.20	redox
11	uvrR	10.08	DNA	38	cdaR	1.72	cellkilling	65	sodB	1.31	redox	92	yajR	1.19	drug
12	yafN	9.78	DNA	39	tam	1.68	detox	66	dnaJ	1.30	protein	93	rpoD	1.18	protein
13	mug	8.71	DNA	40	phoB	1.64	general	67	sanA	1.30	drug	94	ompC	1.18	cellkilling
14	ybfE	8.16	DNA	41	lon	1.62	protein	68	ssrA	1.29	drug	95	fsr	1.18	drug
15	polA	7.83	DNA	42	bolA	1.62	general	69	ahpF	1.28	redox	96	cspB	1.17	general
16	ada	6.75	DNA	43	sodA	1.61	redox	70	entC	1.28	protein	97	ydeO	1.17	cellkilling
17	recE	5.59	DNA	44	fpr	1.55	detox	71	sdhC	1.28	general	98	katE	1.17	redox
18	ftsk	5.52	DNA	45	yeiG	1.55	detox	72	cmr	1.28	drug	99	cyoA	1.16	general
19	sbmC	4.86	DNA	46	uspA	1.54	general	73	amiC	1.28	drug	100	slyA	1.16	cellkilling
20	yedW	4.68	drug	47	ssb	1.53	DNA	74	pbpG	1.26	drug	101	dps	1.16	redox
21	clpB	4.63	DNA	48	yfjG	1.52	cellkilling	75	gst	1.26	detox	102	ycgE	1.14	protein
22	mutM	4.54	DNA	49	zntA	1.45	detox	76	dacB	1.26	drug	103	inaA	1.14	redox
23	polB	4.37	DNA	50	emrA	1.44	drug	77	dacA	1.26	drug	104	cueR	1.14	protein
24	recN	4.10	DNA	51	yeaE	1.42	detox	78	emrE	1.25	drug	105	dinJ	1.14	cellkilling
25	mutH	3.99	DNA	52	otsB	1.41	general	79	marC	1.25	drug	106	soxR	1.13	redox
26	mutY	3.71	DNA	53	ydgL	1.41	general	80	marR	1.25	drug	107	clpB	1.12	protein
27	yjiW	3.53	DNA	54	bacA	1.40	drug	81	soxS	1.24	redox	108	cspA	1.10	general

Table S14 GSEA Ranking results for H_2O_2 (six concentrations) based on CPCA score.

rank	name	score	pathway	rank	name	score	pathway	rank	name	score	pathway	rank	name	score	pathway
1	sodC	0.941	redox	28	katE	0.014	redox	55	rpoD	0.004	protein	82	uvrR	0.001	DNA
2	rpoE	0.796	general	29	katG	0.014	redox	56	ahpC	0.004	redox	83	mutY	0.001	DNA
3	bolA	0.357	general	30	umuD	0.013	DNA	57	sulA	0.004	DNA	84	cmr	0.001	drug
4	norR	0.063	detox	31	dacB	0.013	drug	58	mdtK	0.003	drug	85	rnt	0.001	DNA
5	sodB	0.061	redox	32	lexA	0.012	DNA	59	polA	0.003	DNA	86	soxS	0.001	redox
6	fpr	0.039	detox	33	dinB	0.011	DNA	60	ydeO	0.003	cellkilling	87	marC	0.001	drug
7	phoB	0.038	general	34	emrE	0.011	drug	61	ydgL	0.003	general	88	grpE	0.001	protein
8	ada	0.029	DNA	35	uspA	0.010	general	62	oxyR	0.003	redox	89	mug	0.001	DNA
9	yfjG	0.027	cellkilling	36	ftsk	0.009	DNA	63	gst	0.002	detox	90	dinJ	0.001	cellkilling
10	ybfE	0.026	DNA	37	ahpF	0.009	redox	64	sbmC	0.002	DNA	91	yjiW	0.001	DNA
11	zntA	0.024	detox	38	crp	0.008	cellkilling	65	mutT	0.002	DNA	92	yeeV	0.001	cellkilling
12	yniC	0.024	detox	39	uvrA	0.008	DNA	66	mutH	0.002	DNA	93	recX	0.001	DNA
13	uspB	0.023	detox	40	ompC	0.008	cellkilling	67	fepB	0.002	protein	94	yeaE	0.001	detox
14	tam	0.022	detox	41	relB	0.007	cellkilling	68	dnaQ	0.002	DNA	95	pbpG	0.001	drug
15	amiC	0.020	drug	42	gadX	0.007	cellkilling	69	clpB	0.002	protein	96	dnaJ	0.001	protein
16	yeiG	0.020	detox	43	slyA	0.007	cellkilling	70	yajR	0.002	drug	97	cueR	0.000	protein
17	cdaR	0.020	cellkilling	44	sbmA	0.007	drug	71	cyoA	0.002	general	98	ruvA	0.000	DNA
18	sodA	0.019	redox	45	recA	0.007	DNA	72	ykfG	0.002	DNA	99	cspA	0.000	general
19	marR	0.019	drug	46	dps	0.006	redox	73	mrcB	0.002	drug	100	dnaK	0.000	protein
20	yedW	0.018	drug	47	sanA	0.006	drug	74	fsr	0.002	drug	101	mutS	0.000	DNA
21	nfo	0.017	DNA	48	ssb	0.006	DNA	75	soxR	0.002	redox	102	entC	0.000	protein
22	bacA	0.017	drug	49	yebG	0.006	DNA	76	yafN	0.002	DNA	103	clpB	0.000	DNA
23	otsB	0.016	general	50	uvrD	0.006	DNA	77	mutM	0.002	DNA	104	mha	0.000	DNA
24	dacA	0.016	drug	51	emrA	0.006	drug	78	lon	0.001	protein	105	dinG	0.000	DNA
25	yhjX	0.015	drug	52	inaA	0.005	redox	79	ycgE	0.001	protein	106	sdhC	0.000	general
26	cls	0.015	drug	53	recN	0.005	DNA	80	ssrA	0.001	drug	107	ybgL	0.000	cellkilling
27	polB	0.014	DNA	54	cspB	0.004	general	81	recE	0.001	DNA	108	uvrC	0.000	DNA

Table S15 GSEA Ranking results for H_2O_2 (six concentrations) based on TELI.

rank	name	score	pathway	rank	name	score	pathway	rank	name	score	pathway	rank	name	score	pathway
1	zntA	11.96	detox	28	sbmC	1.93	DNA	55	cyoA	1.52	general	81	sanA	1.27	drug
2	ruvA	3.74	DNA	29	dnaJ	1.91	protein	56	crp	1.51	cellkilling	82	ycgE	1.24	protein
3	yedW	3.51	drug	30	ftsk	1.89	DNA	57	emrE	1.5	drug	83	marC	1.23	drug
4	umuD	3.25	DNA	31	yfjG	1.88	cellkilling	58	dnaK	1.48	protein	84	mutT	1.23	DNA
5	flgM	3.24	detox	32	amiC	1.8	drug	59	uvrC	1.48	DNA	85	yhjX	1.23	drug
6	nfo	3.14	DNA	33	uspB	1.79	redox	60	yeiG	1.45	detox	86	grpE	1.21	protein
7	dacA	3.06	drug	34	oxyR	1.79	redox	61	gst	1.44	detox	87	yjiW	1.2	DNA
8	uvrY	2.92	DNA	35	cueR	1.77	protein	62	dinJ	1.44	cellkilling	88	mug	1.18	DNA
9	lon	2.86	protein	36	uvrD	1.76	DNA	63	cspA	1.43	general	89	grxA	1.12	DNA
10	ompC	2.83	cellkilling	37	entC	1.76	protein	64	otsB	1.43	general	90	cls	1.11	drug
11	recN	2.76	DNA	38	ybfE	1.75	DNA	65	katE	1.42	redox	91	mutS	1.1	DNA
12	dinG	2.76	DNA	39	dacB	1.71	drug	66	norR	1.42	detox	92	recX	1.09	DNA
13	tam	2.7	detox	40	ydeO	1.69	cellkilling	67	ssrA	1.39	drug	93	sulA	1.08	DNA
14	gadX	2.52	cellkilling	41	soxR	1.68	redox	68	yeeV	1.39	cellkilling	94	uvrA	1.08	DNA
15	sodC	2.51	redox	42	uspA	1.65	general	69	clpB	1.39	DNA	95	yafN	1.08	DNA
16	phoB	2.5	general	43	bolA	1.64	general	70	slyA	1.38	cellkilling	96	ykfG	1.05	DNA
17	katG	2.49	redox	44	mutY	1.61	DNA	71	rpoD	1.37	protein	97	polA	1.05	DNA
18	fsr	2.25	drug	45	ahpF	1.61	redox	72	pbpG	1.37	drug	98	yajR	1.05	drug
19	sodB	2.23	redox	46	yeaE	1.6	detox	73	ada	1.36	DNA	99	rnt	1.05	DNA
20	recA	2.21	DNA	47	polB	1.59	DNA	74	fepB	1.35	protein	100	marR	1.03	drug
21	sodA	2.18	redox	48	mdtK	1.59	drug	75	cmr	1.31	drug	101	recE	1.02	DNA
22	ahpC	2.17	redox	49	ssb	1.59	DNA	76	rpoE	1.31	general	102	mutM	1.01	DNA
23	lexA	2.13	DNA	50	cspB	1.58	general	77	bacA	1.29	drug	103	mutH	1.01	DNA
24	fpr	2.01	detox	51	motA	1.56	detox	78	dinB	1.28	DNA	104	yebG	1	DNA
25	dnaQ	1.99	DNA	52	sdhC	1.56	general	79	soxS	1.28	redox	105	sbmA	1	drug
26	ytfE	1.95	redox	53	inaA	1.54	redox	80	ydgL	1.27	general	106	emrA	1	drug
27	relB	1.93	cellkilling	54	dps	1.54	redox	81	sanA	1.27	drug	107	mrcB	1	drug

Table S16. GSEA Ranking results for Pb^{2+} (six concentrations) based on CPCA score.

rank	name	score	pathway	rank	name	score	pathway	rank	name	score	pathway	rank	name	score	pathway
1	yebG	0.855	DNA	28	ruvA	0.045	DNA	55	ftsk	0.024	DNA	82	slyA	0.012	cellkilling
2	sbmA	0.490	drug	29	uvrA	0.044	DNA	56	lexA	0.024	DNA	83	fsr	0.012	drug
3	polA	0.208	DNA	30	bacA	0.044	drug	57	yeaE	0.022	detox	84	mutS	0.012	DNA
4	recE	0.171	DNA	31	yeiG	0.043	detox	58	dnaK	0.021	protein	85	cspA	0.012	general
5	yafN	0.106	DNA	32	bolA	0.043	general	59	sanA	0.021	drug	86	amiC	0.011	drug
6	katG	0.105	redox	33	rnt	0.042	DNA	60	marC	0.021	drug	87	mutY	0.011	DNA
7	fpr	0.105	detox	34	mutT	0.041	DNA	61	sbmC	0.021	DNA	88	pbpG	0.010	drug
8	mdtK	0.102	drug	35	ybfE	0.040	DNA	62	gadX	0.020	cellkilling	89	oxyR	0.010	redox
9	uspA	0.090	general	36	ydgL	0.040	general	63	dinB	0.020	DNA	90	sodC	0.010	redox
10	ahpF	0.086	redox	37	ahpC	0.039	redox	64	uspB	0.020	detox	91	fepB	0.010	protein
11	yfjG	0.082	cellkilling	38	mutM	0.039	DNA	65	otsB	0.020	general	92	ompC	0.010	cellkilling
12	norR	0.078	detox	39	dps	0.039	redox	66	soxR	0.019	redox	93	cueR	0.008	protein
13	sodA	0.077	redox	40	sulA	0.037	DNA	67	cspB	0.018	general	94	clpB	0.008	DNA
14	emrA	0.073	drug	41	uvrC	0.037	DNA	68	umuD	0.018	DNA	95	grpE	0.008	protein
15	yjiW	0.063	DNA	42	ada	0.036	DNA	69	mrcB	0.018	drug	96	soxS	0.008	redox
16	relB	0.062	cellkilling	43	yajR	0.036	drug	70	cdaR	0.018	cellkilling	97	cmr	0.007	drug
17	marR	0.060	drug	44	cls	0.034	drug	71	emrE	0.017	drug	98	ydeO	0.007	cellkilling
18	mug	0.057	DNA	45	dnaQ	0.033	DNA	72	ybgL	0.016	cellkilling	99	clpB	0.007	protein
19	mutH	0.056	DNA	46	nfo	0.032	DNA	73	entC	0.016	protein	100	recA	0.006	DNA
20	sodB	0.056	redox	47	dacB	0.031	drug	74	dacA	0.016	drug	101	lon	0.005	protein
21	katE	0.054	redox	48	uvrR	0.031	DNA	75	ssb	0.016	DNA	102	dnaJ	0.004	protein
22	yhjX	0.053	drug	49	yedW	0.030	drug	76	recN	0.015	DNA	103	dinJ	0.004	cellkilling
23	mha	0.052	DNA	50	ssrA	0.029	drug	77	ycgE	0.015	protein	104	rpoD	0.004	protein
24	rpoE	0.052	general	51	recX	0.029	DNA	78	dinG	0.013	DNA	105	yniC	0.003	detox
25	phoB	0.048	general	52	yeeV	0.029	cellkilling	79	uvrD	0.013	DNA	106	zntA	0.003	detox
26	tam	0.047	detox	53	polB	0.026	DNA	80	sdhC	0.012	general	107	cyoA	0.002	general
27	ykfG	0.046	DNA	54	inaA	0.026	redox	81	crp	0.012	cellkilling	108	gst	0.001	detox

Table S17. GSEA Ranking results for Pb^{2+} (six concentrations) based on TELI

rank	name	score	pathway	rank	name	score	pathway	rank	name	score	pathway	rank	name	score	pathway
1	fpr	5.07	detox	28	relB	2.01	cellkilling	55	gst	1.72	detox	81	recE	1.42	DNA
2	motA	4.65	detox	29	fsr	1.99	drug	56	grpE	1.7	protein	82	emrA	1.38	drug
3	soxS	4.36	redox	30	marR	1.99	drug	57	uvrC	1.68	DNA	83	recX	1.36	DNA
4	sodC	3.18	redox	31	ycgE	1.99	protein	58	nfo	1.64	DNA	84	uvrA	1.35	DNA
5	katG	3.04	redox	32	recN	1.99	DNA	59	mutH	1.64	DNA	85	rpoD	1.34	protein
6	marC	2.87	drug	33	umuD	1.98	DNA	60	dnaQ	1.64	DNA	86	rnt	1.34	DNA
7	lon	2.8	protein	34	cmr	1.97	drug	61	mdtK	1.61	drug	87	yafN	1.33	DNA
8	zntA	2.72	detox	35	mug	1.96	DNA	62	dinB	1.61	DNA	88	ssb	1.3	DNA
9	cyoA	2.7	general	36	oxyR	1.96	redox	63	lexA	1.58	DNA	89	cspA	1.28	general
10	gadX	2.44	cellkilling	37	sdhC	1.93	general	64	yhjX	1.57	drug	90	yjiW	1.27	DNA
11	ahpF	2.38	redox	38	dacA	1.93	drug	65	mutY	1.57	DNA	91	rpoE	1.26	general
12	katE	2.37	redox	39	sanA	1.89	drug	66	ada	1.56	DNA	92	mutM	1.24	DNA
13	dnaK	2.36	protein	40	cspB	1.88	general	67	polB	1.55	DNA	93	sulA	1.23	DNA
14	yedW	2.34	drug	41	soxR	1.87	redox	68	uspA	1.54	general	94	inaA	1.23	redox
15	ydeO	2.25	cellkilling	42	ftsk	1.86	DNA	69	flgM	1.54	detox	95	clpB	1.22	DNA
16	ruvA	2.25	DNA	43	cls	1.84	drug	70	ompC	1.51	cellkilling	96	dps	1.21	redox
17	ydgL	2.23	general	44	dnaJ	1.83	protein	71	bolA	1.5	general	97	norR	1.2	detox
18	emrE	2.2	drug	45	bacA	1.81	drug	72	grxA	1.48	DNA	98	polA	1.2	DNA
19	yajR	2.19	drug	46	entC	1.77	protein	73	sodA	1.48	redox	99	uvrD	1.19	DNA
20	mrcB	2.19	drug	47	cueR	1.76	protein	74	slyA	1.48	cellkilling	100	ykfG	1.18	DNA
21	otsB	2.18	general	48	uvrY	1.76	DNA	75	yfjG	1.47	cellkilling	101	uspB	1.18	redox
22	pbpG	2.17	drug	49	ybfE	1.75	DNA	76	amiC	1.46	drug	102	recA	1.15	DNA
23	yeaE	2.16	detox	50	dinJ	1.75	cellkilling	77	yeiG	1.44	detox	103	yebG	1.11	DNA
24	yeeV	2.15	cellkilling	51	ssrA	1.75	drug	78	mutS	1.43	DNA	104	sodB	1.05	redox
25	dacB	2.15	drug	52	crp	1.74	cellkilling	79	ahpC	1.43	redox	105	ytfE	1.04	redox
26	fepB	2.14	protein	53	dinG	1.74	DNA	80	sbmA	1.42	drug	106	tam	1.02	detox
27	sbmC	2.12	DNA	54	mutT	1.73	DNA	81	recE	1.42	DNA	107	phoB	1	general

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