- Supporting Information –

Assessing Inorganic Nanoparticle Toxicity through Omics Approaches

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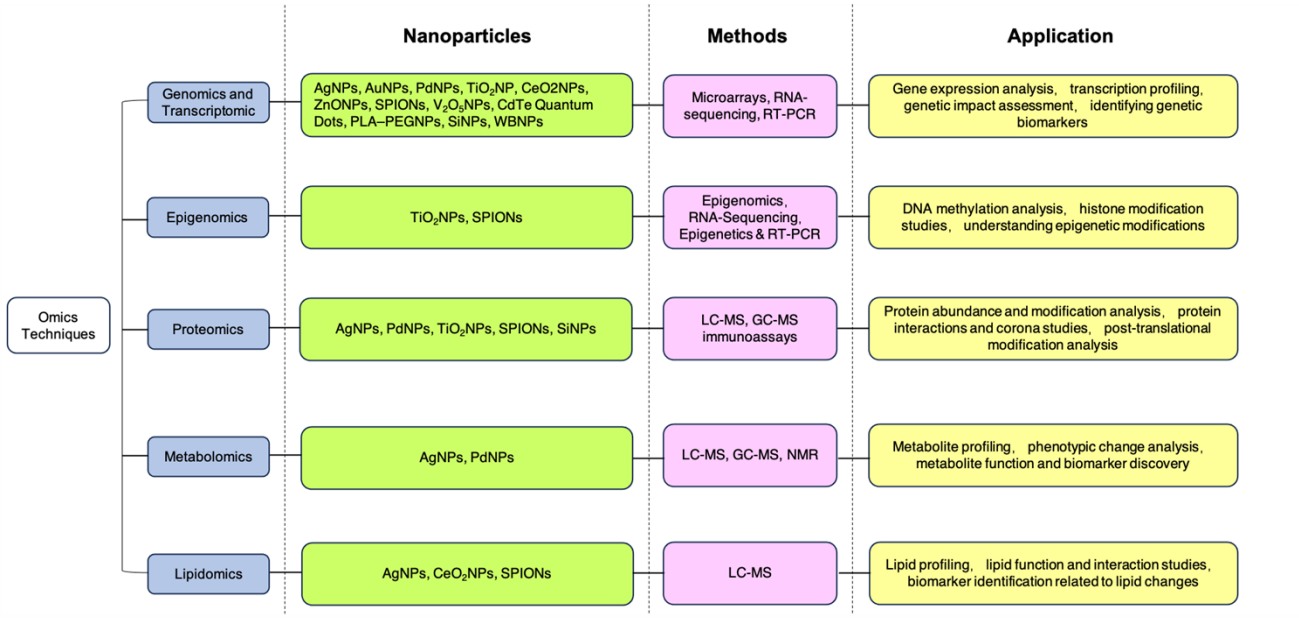

Figure S1. Overview of the omics techniques used for assessing nanoparticle toxicity discussed in the review.

Table S1. Summary of omics studies that characterize the toxicity of nanoparticles

Nanoparticle properties			Shell properties		Toxicity testing			Ref.
Type	**Size (nm)**	**Shape**	**Shell material**	**Charge**	**Testing type**	**Model**	**Omics**	
AgNPs	20	Spherical	n/a	n/a	In vitro	Human dermal fibroblasts-fetal (HDF-f) cells	Transcriptomics	[100]
AgNPs	20	Spherical	n/a	n/a	In vitro	Human dermal fibroblasts-fetal (HDF-f) cells	Transcriptomics	[101]
AgNPs	10, 30, and 60	Spherical	Citrate, polyethylene glycol (PEG), bovine serum albumin (BSA)	Citrate-coated NPs: Negative (-29 ~ 43 mV) PEG-/BSA- coated NPs: Negative (-12 ~ 18 mV)	In vitro	Human skin keratinocytes (HaCaT) cells	Metabolomics	[102]
AgNPs	15.9 ± 7.6	Spherical	Citrate	Negative (−21.6 ± 1.3 mV)	In vitro	Human lung epithelial (A549) cells	Transcriptomics	[105]
AgNPs	5 and 100	Spherical	PVP	n/a	In vitro	Human endothelial (EA.hy926) cells and bronchial epithelial (BEAS-2B) cells	Transcriptomics	[106]
AgNPs	7-10	n/a	Polyethyleneimine	n/a	In vitro	Human hepatoma (HepG2) cells	Transcriptomics	[109]
AgNPs	16.1 ± 5.3	Spherical	PVP	Negative (−19 mV)	In vitro	Carp gill mitochondria	Proteomics	[110]
AgNPs	20-50	Spherical	GSH	Negative (−8~10 mV)	In vitro	Human hepatoma (HepG2) cells	Transcriptomics	[111]
AgNPs	91.7 ± 1.6	Spherical	n/a	Negative (− 6.3 ± 0.4 mV)	In vitro	Human hepatoma (HepG2) cells	Lipidomics	[77]
AgNPs	30	Spherical	Citrate	n/a	In vitro	Human colon adenocarcinoma (Caco-2) cells	Proteomics	[112]
AgNPs	25	n/a	n/a	n/a	In vivo	Colon tissue of male C57BL/6J mice	Transcriptomics	[115]
AgNPs	10 and 40	Spherical	Citrate	n/a	In vivo	Zebrafish embryos	Transcriptomics	[116]
AgNP	25.5	n/a	n/a	n/a	In vivo	Zebrafish embryos	Metabolomics	[117]
AuNPs	21.8 ± 4.8	Spherical	Citrate	n/a	In vitro	Human dermal fibroblast (HDF-f) cells	Transcriptomics	[127]
AuNPs	20	Spherical	n/a	n/a	In vitro	Human lung epithelial (A549) cells	Metabolomics	[128]
PdNPs	10	Spherical	Hesperidin	Negative (−15.4 ± 1.3mV)	In vitro	Human ovarian cancer (SKOV3) cells	Transcriptomics	[141]
PdNPs	141.3 ± 5.5	Spherical	n/a	Positive (49.2 ± 1.9mV)	In vivo	Earthworms	Transcriptomics	[142]
PdNPs	10 ± 6	n/a	n/a	Negative (−25.9 ± 5.6 mV)	In vitro	rat embryo fibroblasts (Rat-1) and human lung epithelial (A549) cells	Proteomics	[143]

TiO_2NPs	7, 20, and 200	n/a	n/a	n/a	In vitro	Human epidermal keratinocyte (HaCaT) cells	Transcriptomics	[169]
TiO_2NPs	20.6	Spherical	n/a	n/a	In vivo	Bronchoalveolar lavage (BAL) and lung tissue of female C57BL/6 mice	Transcriptomics and proteomics	[171]
TiO_2NPs	6	n/a	Hydroxypropyl methylcellulose (HPMC)	Positive (9.28 mV)	In vitro	Bronchoalveolar lavage (BAL) and lung tissue of female CD-1 mice	Transcriptomics	[172]
TiO_2NPs	25	Spherical	n/a	Negative (−21.0 ± 0.7 mV)	In vitro	Human hepatoma (HepG2) cells	Transcriptomics	[177]
TiO_2NPs	25	Spherical	n/a	Negative (−10.8 mV)	In vivo	Lung tissue of female NIH mice	Transcriptomics and epigenomics	[173]
TiO_2NPs	n/a	n/a	n/a	n/a	In vitro	Lung fibroblast (MRC5) cells	Epigenomics	[174]
TiO_2NPs	< 25	Spherical	n/a	n/a	In vitro	Human epidermal keratinocytes (HaCaT) cells	Transcriptomics and proteomics	[170]
CeO_2NPs	4.0 ± 1.1	n/a	Tetra-methyl ammonium hydroxide (TMAOH)	Negative (−45 mV)	In vitro	Human lung epithelial (A549) cells and bronchial (BEAS-2B) epithelial cells	Transcriptomics	[205]
CeO_2NPs	8	Spherical	n/a	n/a	In vivo	Lung tissue of Sprague–Dawley (SD) rats	Lipidomics and transcriptomics	[8]
ZnONPs	100 and 300	n/a	Triethoxycapry-lylsilane	n/a	In vivo	Bronchoalveolar lavage (BAL) fluid cellularity of female C57BL/6J BomTac mice	Transcriptomics	[184]
ZnONPs	20–50	Spherical	n/a	Positive (20.0 ± 6.5 mV)	In vitro and in vivo	Human hepatoma (HepG2) cells	Transcriptomics	[185]
ZnONPs	158	Rectangular, rod, spherical, and irregular shapes	n/a	Negative (− 19 ± 1 mV)	In vitro	Alveolar macrophages (NR8383)	Transcriptomics and proteomics	[188]
ZnONPs	355.6 ± 68.2	Spherical	n/a	Negative (−17.9 ± 0.2 mV)	In vivo	Female and male zebrafish (Danio rerio)	Transcriptomics and metabolomics	[186]
NiONPs	750	n/a	n/a	n/a	In vitro	Human bronchial epithelial (BEAS-2B) cells	Transcriptomics	[208]
SPIONs	10	Irregular	Citric acid	Negative (− 40 mV)	In vitro	Human submandibular gland (HSG) cells	Transcriptomics and epigenomics	[195]
SPIONs	20	n/a	n/a	Positive (27.4 ± 1.1 mV)	In vitro	Mouse macrophage (RAW 264.7) cells	Proteomics and lipidomics	[197]
V_2O_5NPs	36 ± 2	Irregular	n/a	n/a	In vitro	Human bronchial epithelial (BEAS-2B) cells	Metabolomics	[206]
CdTe quantum dots	55.6	n/a	n/a	n/a	In vitro	Human monocyte (THP-1) cells	Proteomics	[218]
SiNPs	65.0 ± 7.4	Spherical	n/a	Negative (−20.5 ± 1.5 mV)	In vitro	Spermatocyte (GC-2spd) cells	Transcriptomics	[223]
SiNPs	58	Spherical	n/a	Negative (−30 mV)	In vitro	Human hepatic (L-02) cells	Metabolomics and proteomics	[224]

WBNPs	149	n/a	n/a	n/a	In vitro	Human lung alveolar epithelial (HPAEpiC) cells	Transcriptomics	[147]
PtNPs	5–45	Spherical	Lycopene	n/a	In vitro	Human acute monocytic leukemia (THP-1) cells	Transcriptomics	[155]
Gd_2O_3NPs	3-4	n/a	n/a	n/a	In vitro and in vivo	4T1 breast cancer cells and female Bal/bc mice	Genomics, transcriptomics and metabolomics	[209]
MoO_2NPs	64 ± 18	Spherical	PVP	Negative (<−30 mV)	In vitro	Rat type II alveolar epithelial cells	Transcriptomics, metabolomics and proteomics	[211]
Mn_3O_4NPs	100	n/a	n/a	n/a	In vitro	Lung epithelial (CCL-149) cells	Transcriptomics	[210]