

## Supplementary Information

**Table S1 Approved nanomedicine for tumor therapy**

Type of Nanomaterials	Trade Name	Therapeutic type	Active Ingredients	Nanocarrier	Administration route	Indications	Approval date
Lipid-based nanomaterials	Doxil/Caelyx	Chemotherapy	Doxorubicin	PEGylated liposomes	iv.	Kaposi sarcoma, breast cancer, ovarian cancer, multiple myeloma	1995
□	DaunoXome	Chemotherapy	Daunorubicin	Liposomes	iv.	Kaposi sarcoma	1996
□	DepoCyt	Chemotherapy	Cytarabine	Liposomes	iv.	Lymphomatous meningitis	1999
□	Myocet	Chemotherapy	Doxorubicin hydrochloride	Liposomes	iv.	Breast cancer	2000
□	Lipusu	Chemotherapy	Paclitaxel	Liposomes	iv.	Ovarian cancer, non-small-cell lung cancer, breast cancer,metastatic gastric cancer	2003
□	Mepact	Chemotherapy	Mifamurtide	Liposomes	iv.	Osteogenic sarcoma	2009
□	Ameluz	Chemotherapy	5-aminolevulinic acid	Liposomes	it.	Nodular basal cell carcinoma	2011
□	Marqibo	Chemotherapy	Vincristine sulfate	Liposomes	iv.	Lymphoblastic leukemia	2012
□	Lipodox	Chemotherapy	Doxorubicin hydrochloride	Liposome	iv.	Kaposi's sarcoma, ovarian cancer, multiple myeloma, metastatic pancreatic cancer	2013
□	Onivyde	Chemotherapy	Irinotecan	PEGylated liposomes	iv.	Metastatic pancreatic cancer	2015
□	DHP107	Chemotherapy	Paclitaxel	Lipid nanoparticles	po.	Advanced gastric cancer	2016
□	Vyxeos	Chemotherapy	Cytarabine and daunorubicin	Liposomes	iv.	Acute myeloid leukemia	2017

□	LipoplatinT M	Chemotherapy	Cisplatin	Liposomes	iv.	Pancreatic cancer, lung cancer	2018
<b>Polymer-based nanomaterials</b>	SMANCS	Chemotherapy	Neocarzinostatin	Polymeric conjugate	ia.	Hepatocellular carcinoma	1993
□	Oncaspar	Chemotherapy	Pegaspargase	Polymeric micelles	iv.	Acute lymphoblastic leukemia,chronic myelogenous leukemia	1994
□	Genexol- PM	Chemotherapy	Paclitaxel	Polymeric micelles	iv.	Breast cancer, small cell lung cancer	2007
□	Eligard	Chemotherapy	Leuprolide acetate	Polymeric micelles	iv.	Prostate cancer	2002
□	Nanoxel	Chemotherapy	Paclitaxel	Polymeric micelles	iv.	Breast cancer, ovarian cancer	2007
□	DocetaxelP M	Chemotherapy	Docetaxel	Polymeric micelles	iv.	Breast cancer, gastric cancer, non-small-cell lung cancer, ovarian cancer, prostate cancer, squamous cell cancer	2013
□	Paclical	Chemotherapy	Paclitaxel	Polymeric micelles	iv.	Pancreatic cancer, metastatic breast cancer, ovarian cancer	2015
□	Apealea	Chemotherapy	Paclitaxel	Polymeric micelles	iv.	Ovarian cancer, peritoneal cancer, fallopian tube cancer	2018
<b>Protein-based Nanomaterials</b>	Ontak	Chemotherapy	Denileukin Diftitox	Protein	iv.	Cutaneous T-cell lymphoma, leukemia	1999
□	Abraxane	Chemotherapy	Paclitaxel	Albumin	iv.	Breast cancer, non-metastatic small cell lung cancer, metastatic pancreatic adenocarcinoma	2005

<input type="checkbox"/>	Pazenir	Chemotherapy	Paclitaxel	Albumin	iv.	Metastatic breast cancer, metastatic pancreatic cancer, non-small cell lung cancer	2019
<input type="checkbox"/>	Fyarro	Chemotherapy	Sirolimus	Albumin	iv.	Malignant perivascular epithelioid cell tumor	2021
<b>Inorganic Nanomaterials</b>	NanoTherm	Hyperthermia	/	Iron oxide nanoparticles	iv./it.	Glioblastoma, prostate cancer, pancreatic cancer.	2010
<input type="checkbox"/>	Hensify	Radiotherapy enhancer	/	Hafnium oxide nanoparticles	it.	Locally advanced soft tissue sarcoma	2019

iv. intravenous injection

ia. intraarterial injection

it. intratumoral injection

**Table S2 Representative nanomaterials for regulating redox metabolism in cancer cells**

Classification	Nanomaterials	Targets	Therapeutic type	Indications	Ref.
<b>Regulation of metabolite levels</b>	Ptp-Fe	O <sub>2</sub> -derived ROS	PDT	murine colon cancer and breast tumors	135
	PEBVO@PEG NRs	O <sub>2</sub> -derived ROS	SDT	breast cancer	150
	IL-LM-ZrO <sub>2</sub>	O <sub>2</sub> -derived ROS	MDT	murine hepatoma	154
	AIE-Au	O <sub>2</sub> -derived ROS	RDT and RT	glioblastoma, hepatocellular carcinoma and prostate cancer	158
	PFV-L@PEG-FA-NPs	O <sub>2</sub> -derived ROS	CL-PDT	breast cancer	167
	SiO <sub>2</sub> -MB@MnO	H <sub>2</sub> O <sub>2</sub> -derived ROS	O <sub>2</sub> self-supplied PDT	cervical cancer	194
	Fe@Fe <sub>3</sub> O <sub>4</sub> -Cu <sub>2</sub> O	H <sub>2</sub> O <sub>2</sub> -derived ROS	CDT	breast cancer	209
	Cu-TCPP MOFs	H <sub>2</sub> O <sub>2</sub> -derived ROS	CDT	cervical cancer	228
	InN@In <sub>2</sub> S <sub>3</sub> nanorod	H <sub>2</sub> O-derived ROS	O <sub>2</sub> self-supplied PDT	glioblastoma	231
	Hf-TP-SN	H <sub>2</sub> O-derived ROS	RT and chemotherapy	colon cancer and breast cancer	245
	W <sub>18</sub> O <sub>49-x</sub> nanobrush	H <sub>2</sub> O-derived ROS	SDT	breast cancer	246
	Pt NPs	H <sub>2</sub> O-derived ROS	EDT	breast cancer	255
	CoFe <sub>2</sub> O <sub>4</sub> -BiFeO <sub>3</sub>	H <sub>2</sub> O-derived ROS	MEDT	breast cancer	256
	HSA-Ce6-CuO <sub>2</sub>	organic lipid hydroperoxides-derived ROS	O <sub>2</sub> /H <sub>2</sub> O <sub>2</sub> self-supplied CDT and PDT	breast cancer	264
	IO-LAHP NPs	Inorganic metal peroxides-derived ROS	Oxidation therapy	glioblastoma	267
	FeAl-LDH@DHA	small molecule donor-derived ROS	CDT and chemotherapy	breast cancer	272
	HSCPs	GSH biosynthesis	CDT	orthotopic murine breast tumors	277
	BAY-876/V-9302@HSA NPs	GSH biosynthesis	Oxidation therapy and starvation therapy	pancreatic cancer	284
	BSO-CAT@MOF-199@DDM	GSH biosynthesis	Cuproptosis	glioblastoma	296
	Ce6@RMOF	GSH	GSH depletion-augmented PDT	breast cancer	304
BEM	GSH	CDT	colon cancer and breast cancer	309	
SnS <sub>1.68</sub> -WO <sub>2.41</sub> nanocatalyst	GSH	Hole therapy and gas therapy	breast cancer	311	

<b>Regulation of enzyme activity</b>	DHM@RSL3	GSH regeneration and NADPH	Ferroptosis	breast cancer	338
	SPNA	GSH regeneration	Chemotherapy	hepatoma	343
	ArgCCN	RNS	Gas therapy	breast cancer	356
	Lip-DTI/NO NPs	RNS	Nitrosative stress, PDT and PTT	pancreatic cancer	372
	Ir-N <sub>5</sub> SA	NADH	Catalytic therapy ; breast cancer	breast cancer	384
	PEG-DOX@Cu	Endogenous NOXs	CDT	glioblastoma	395
	Pt+ Hb Hydrogel	Endogenous NOXs	CDT	lung cancer	396
	MCRT	Endogenous CAT	CDT and gene therapy	breast cancer	407
	cRGD-AuPNSs	Endogenous TrxR	Chemotherapy and PTT	cervical cancer	418
	DBCO-8ArmPEG-SS- DHA@RSL3	Endogenous GPx4	Ferroptosis	breast cancer	427
	TAF-HMON-CuP@PPDG	Endogenous GPx4	CDT	breast cancer	428
	PZB@Lip NPs	Endogenous HO- 1	PDT	breast cancer	438
	siRNA-ApFe-PLNPs	Endogenous MTH1	CDT	lung cancer	445
	Lip-(2DG + Dox)	Endogenous HK	Chemotherapy	cervical cancer	456
	DMSN/Fe <sub>3</sub> O <sub>4</sub> -Mn@CB-839	Endogenous glutaminase	CDT	colon cancer	483
	UCNPs@G4/Ce6/CAT-CTPP	Exogenous CAT	PDT	breast cancer	495
	AG@Cu <sub>9</sub> S <sub>8</sub> @dOMV	Exogenous GOx	CDT , PTT and chemotherapy	glioblastoma	507
	Co-PN <sub>3</sub> SA/CHO	Exogenous CHO	Catalytic therapy	glioblastoma	521
	TYR@NPCN-333-APAP	Exogenous tyrosinase	Chemotherapy	cervical cancer	527
	nHs	Exogenous HRP	Chemotherapy	cervical cancer	530
SOD/CPO-loaded nanogel system (SCNG)	Exogenous SOD and CPO	Catalytic therapy	Hepatocellular carcinoma	531	
GOx/HRP-LNRs	Exogenous GOx and HRP	Catalytic therapy	breast cancer	538	
Hybrid semiconducting nanozyme (HSN)	Nanozyme with POD-like activity	ferrotherapy and PTT	breast cancer	560	

	FeCo/Fe-Co DAzyme/PL	Nanozyme with quadruple enzymatic activity(OXD, GSHOx, CAT, and POD)	Catalytic therapy	breast cancer	569
<b>Regulation of signaling pathway</b>	siNrf2-ICG@ZIF-8-DSPE-PEG (RI@Z-P)	Nrf2	PDT	melanoma	591
	TP/2-DG @HMnO <sub>2</sub> @HA	Nrf2	CDT	lung cancer	604
	Cu <sub>2-x</sub> Se/ZIF-8@Era-PEG-FA	HIF-1 $\alpha$	ferroptosis	breast cancer	626
	LipoCu-OA/ACF	HIF-1	CDT and immunotherapy	breast cancer	635
	CeBez	mTOR	PDT and chemotherapy	breast cancer	647