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Cancer Nanותרanostics

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Cancer Nanotheranostics

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Preface

*Diagnose the illness, trace its cause,
seek the proper remedy and apply it with skill.*

—Thirukural (Verse 948) by Thiruvalluvar, a Tamil Poet (2 B.C–8 A.D)

In spite of being the major cause of death, efficient cancer therapy and its early diagnosis remains elusive for the researchers around the world. With the advent of new nanomaterials, the present century has revolutionized the application of nanoscale formulations for healthcare applications, especially in the field of cancer therapy or diagnosis. These nanoscale materials by virtue of their small dimension and improved therapeutic and diagnostic efficacy against cancer have transcended to the next generation of nanoscale formulations capable of achieving cancer therapy and diagnosis simultaneously. Such multifunctional nanoscale formulations would invariably consist of therapeutic and diagnostic components combined together within a nanoscale carrier molecule. Realizing such multifunctional theranostic systems in the imminent future can reinvent the current cancer management strategies.

In concert with the aforementioned theme, this book would provide a clear insight into the recent advances in the field of cancer theranostics with special emphasis on nanoscale carrier molecules (polymeric, protein and lipid based) and imaging agents (organic and inorganic).

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Abbreviations

4T1	Murine breast cancer cell
5-FU	5-Fluorouracil
A549	Human lung cancer cell
ADC	Antibody-drug conjugate
Aft	Apoferritin
AMF	AC magnetic field
Anti-CEA	Anti-carcinoembryonic antigen antibodies
Anti-TAG-72	Tumor associated glycoprotein-72 monoclonal antibodies
ARPE-19	Human retinal pigmented epithelium cell
ATF	Amino-terminal fragment
ATRP	Atom transfer radical polymerization
Au	Gold
Au-DENPs	Dendrimer-entrapped gold nanoparticles
B16	Murine melanoma cell line
BBB	Blood–brain barrier
BCECs	Capillary endothelial cells
BHHBB	1,2-bis[40-(100,100,100,20 0,20 0,300,300-heptafluoro-400,60 0-hexanedion- 600-yl)-benzyl]-benzene
BOPP	4-bis-(a, b-didihydroxyethyl)-deutero-porphyrin IX
BPA	Borophenylalanine
BPT	2-(N,N-diethylanilin-4-yl)-4,6-bis (pyrazol-1-yl)-1,3,5-triazine
BSA	Bovine serum albumin
BT474	Human breast carcinoma cell line
BTZ	Bortezomib
C32	Human amelanotic melanoma cell line
C6	Glioma cells
Caco-2	Human epithelial colorectal adenocarcinoma fibroblasts
CAFs	Cancer-associated fibroblasts

CANIR	Carboxylic acid derivative of the NIR dye IR-783
CAPAN-1	Metastatic pancreatic cancer cell
CBSA	Cationic BSA
CDDP	Cisplatin
C-dots	Carbon dots
Ce6	Chlorin e6
C-gel	Cationic gelatin
ChS-CS	Chondroitin sulfate-chitosan
Con A	Concanavalin A
CPMV	Cowpea mosaic virus
CPZ	Mono-substituted β -carboxy phthalocyanine zinc
CREKA	Cys-Arg-GluLys-Ala
CS-EA	N- Carboxyethyl chitosan ester
CT	Computed tomography
dBSA	Denatured BSA
DC	Dendritic cell
DEVD	Asp-Glu-Val-Asp
DIM-CpPhC6H5 (DIM-P)	c-substituted diindolylmethanes
DNA	Deoxyribonucleic acid
DNCs	Dendrimer nanoclusters
DOTA	1,4,7,10-tetraazacyclododecane-1,4,7,10-tetraacetic acid
Dox	Doxorubicin
DPA	Dipicolylamine
DTPA	Diethylenetriaminepentaacetic acid
ECGC	Epigallocatechin gallate
EGF	Epithelial growth factor
EGFR	Epidermal growth factor receptor
Eph	Erythropoietin-producing hepatoma
EPR	Enhanced permeability and retention
Eu	Europium
FA	Folic acid
FAM	Carboxyfluorescein
FAP	Fibroblast activation protein
FAR	Folic acid receptor
FDA	Food and Drug Administration
FITC	Fluorescein isothiocyanate
Fmp	Fibronectin-mimetic peptide
FMT	Fluorescent molecular tomography
FNPs	Fibrinogen nanoparticles
FR	Folate receptor
FRET	Fluorescence resonance energy transfer
Gd	Gadolinium
Gd-HP-DO3A	Gadolinium 1,4,7-tris(carboxymethyl)- 10-(2'-hydroxypropyl)-1,4,7,10-tetraazacyclododecane

GFP	Green fluorescent protein
GLuc	<i>Gaussia</i> luciferase
GNS	Graphene nanosheets
GNs	Gelatin nanospheres
GRAS	Generally recognized as safe
HA	Hyaluronic acid
HCC	Human hepatocellular carcinoma
HCDs	Hollow C-dots
HCRSV	Hibiscus chlorotic ringspot virus
HCT 116	Human colorectal cancer cell
Hela cells	Human tumor cell line
HepG2	Human hepatoma cell line
Hepli cells	Human normal liver cells
Her	Herceptin
HF _n	Human H-chain ferritin
Hft	Human ferritin
HGF	Hepatocyte growth factor
hGSA	Galactosyl HSA
HINP	HSA coated iron oxide nanoparticles
HIV	Human immunodeficiency virus
HNSCC	Head and neck squamous cell carcinoma
HP	Hematoporphyrin
HPH	High pressure homogenization
HSA	Human serum albumin
Hsp	Heat shock protein
HT1080	Human fibrosarcoma cell
HT-29	Colorectal cancer cell
i.v.	Intravenous
IFN- γ	Interferon gamma
IL	Interleukin
IONPs	Iron oxide nanoparticles
J774	Murine macrophage-like cells
JNK	c-Jun N-terminal kinases
K562	Leukemic cell line
KB	Oral cancer cell line
L929	Mouse fibroblast cell line
LA	Lactobionic acid
LAPTM4B	Lysosomal protein transmembrane 4 beta
Lf	Lactoferrin
LMW	Low molecular weight
LTB	Heat-labile enterotoxin subunit B
LuPO ₄	Lutetium phosphate
mAb	Monoclonal antibody
MCF-10A	Normal breast epithelial cells

MCF-7	Human breast cancer cells
MDA-MB-231	Breast cancer cells
MDA-MB-435S	Human melanoma cell
MDA-MD-231	Breast cancer cell line
MFH	Magnetic fluid hyperthermia
MGC803	Gastric cancer cell
MMPs	Matrix metalloproteinases
mPEG	Methoxy-poly(ethylene glycol)
mPEG 2000	Poly(ethylene glycol) methyl ether 2000
MRI	Magnetic resonance imaging
MSN	Mesoporous silica nanoparticles
MTX	Methotrexate
MWCNT	Multiwalled carbon nanotube
MX	Mitoxantrone
Nano-rGO	Reduced graphene oxide
NCs	Nanoclusters
NFs	Nanoflowers
NHS	N-hydroxysuccinimide
NIH/3T3	Mouse embryonic fibroblast cells
NIR	Near infrared region
NIRF	Near-infrared fluorescence
NLCs	Nanostructured lipid carriers
NOTA	1,4,7-Triazacyclononane-N,N',N''-triacetic acid
NPs	Nanoparticles
O/W emulsion	Oil in water emulsion
OVCAR-3	Ovarian cancer cell
OVCAR-5	Human ovarian cancer cells
PAA	Poly(acrylic acid)
PAH	Poly(allylamine hydrochloride)
PAMAM	Poly(amidoamine)
PBS	Phosphate buffer saline
Pc	Phthalocyanine
PC3	Prostatic Small Cell Carcinoma
PCL	Poly(3-caprolactone)
PDI	Photodynamic imaging
PDMA	Poly(dimethylamino) ethyl methacrylate
pDNA	plasmid DNA
PDT	Photodynamic therapy
PE	Polyelectrolytes
PEA	Phosphatidylethanolamine
PEG	Poly(ethylene glycol)
PEG-PBLA	Poly(ethylene glycol)-poly(benzyl L-aspartate)
PEI	Polyethylenimine
PET	Positron emission tomography

Pf-Fn	<i>Pyrococcus furiosus</i> ferritin
PFVCN	Poly[9,9'-bis(6,6'-(N,N,N-trimethylamini-um)-fluorene-2,7-ylenevinylene-co-alt-2,5-dicyano-1,4-phenylene]
PHA	Polyhydroxyalkanoate
PHEMA-g-PLA	Poly(2-hydroxyethylmethacrylatehistidine)-g-poly-(d,l-lactide)
PLA	Poly(lactic acid)
PLGA	Poly(L lactic-co-glycolic acid)
PNA	Peanut agglutinin
POCM	Peritoneal ovarian cancer metastases
PPEI	Poly(ethylenimide)-co-poly(ethyleneglycol)-co-poly(ethyl-enimide)
PPF	Porphyrin-peptide-folate
PPI	Polypropylenimine
PPSD	PEG-PAMAM-cis-aconityl-Doxorubicin
PS	Photosensitizer
PSMA	Prostate-specific membrane antigen
PSS	Sodium poly(4-styrene sulfonate)
PTT	Photo thermal Therapy
PTX	Paclitaxel
PVX	Potato virus X
QD	Quantum dot
QGY-7703 cells	Human liver cancer cells
QUaPS	Quantitative, unquenched activatable photosensitizers
Qucbl	7-(3-bromopropoxy)-2-quinolylmethyl chlorambucil
RA	Rheumatoid arthritis
RCA	Ricinus communis agglutinin
RES	Reticuloendothelial system
RFRT	Recombinant ferritin
RGD	Cyclic arginine-glycine-aspartate
rHSA	Recombinant HSA
RITC	Rhodamine B isothiocyanate
RME	Receptor-mediated endocytosis
RT4	Human bladder transitional cancer cells
SCID	Severe combined immunodeficient
SFEE	Supercritical Fluid Extraction of Emulsion
SH-gC-dots	Thiol-terminated C-dots
SJSA-1	Osteosarcoma cell
SKBR3	Human breast adenocarcinoma cells
SLN	Solid lipid nanoparticles
SPECT	Single photon emission computed tomography
SPION-TPP	Superparamagnetic iron oxide nanoparticle-porphyrin
SPTPP	(5-N succinimidoxyl- 5-oxopentyl)-triphenylphosphonium bromide