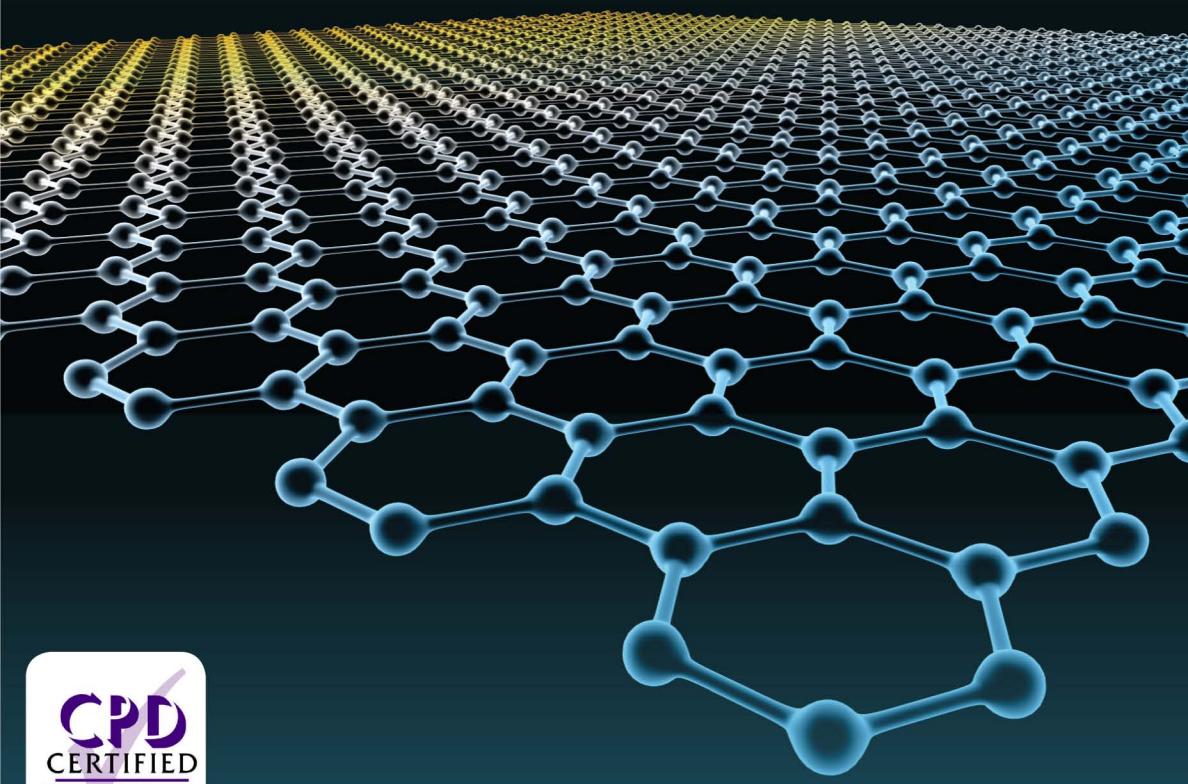
Nanoconjugate Nanocarriers for Drug Delivery



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NANOCONJUGATE NANOCARRIERS FOR DRUG DELIVERY

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Edited by

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The Present Book Is Dedicated to our Beloved

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LIST OF ABBREVIATIONS

Abs	antibodies
ACT	artemisinin-based combination therapy
AD	Alzheimer's disease
ADME	adsorption, distribution, metabolism, and excretion
AFM	atomic force microscopy
AlPcS	aluminum phthalocyanines
AmB	amphotericin B
AmB-PLGA-NS	amphotericin B-loaded PLGA-based nanosphere
apo	apolipoprotein
Apo b	apolipoprotein B
APs	aptamers
ARPES	angle-resolved photoelectron spectroscopy
ART	artemisinin
ASA	amino salicylic acid
AsODN	antisense oligonucleotides
ATD	anti-tubercular drugs
AuCM	gold-cysteamine
BBB	blood–brain barrier
BCG	bacillus Calmette–Guerin
BOB	blood–ocular barrier
BPEI	branched poly-(ethylenimine)
BPGDD	biotin-PEG-GNR-DNA/DOX
BphEA	2-(butylamino)-1-phenyl-1-ethanethiosulfuric acid
BSA-NP	bovine serum albumin nanoparticle
CBD	Centre for Bio-design & Diagnostics
C-dots	carbon quantum dots
CD-C_{10}	cyclodextrin derivatives grafted with decanoic alkyl chain
Ce6	chlorin e6
CM	cerebral malaria
CMC	critical micelle concentration
CNT	carbon nanotube
CP	NIR dye (Cy5.5)-labeled-MMP-14 substrate peptide

CPT	camptothecin
CRISPR	clustered regularly interspaced short palindromic repeats
CS	chitosan
CSC	cancer stem cell
CTLM	circular transmission line model
CVD	chemical vapor deposition
DDFR	dihydrofolate reductase
DDS	drug delivery system
DHA	dihydroartemisinin
DHA-SLN	DHA-loaded solid lipid nanoparticle
DHPS	dihydropteroate synthase
DI-TSL	DOX/ICG-loaded temperature sensitive liposomes
DIVEMA	divinyl ether-maleic anhydride
DLS	dynamic light scattering
DMF	N-N dimethyl formamide
DOPC	dioleyl phosphatidylcholine
DOPG	dioleoyl phosphatidylgycerol
DOX	doxorubicin
DOX@PSS-GNRs	DOX molecules onto the GNRs through PSS
DPPA	dipalmitoyl phosphatidic acid
DPPC	1,2-dipalmitoyl-sn-glycero-3-phosphocholine
DPPC	dipalmitoyl phosphatidylcholine
DPPE	dipalmitoyl phosphatidylethanolamine
DPPS	dipalmitoyl phosphoserine
DSPE-PEG2000	1,2-distearoyl-sn-glycero-3-glycero-3-phosphoethanolamine-N-[(polyethylene glycol)-2000]
DSPE-PEG2000	1,2-distearoyl-sn-glycero-3-phosphoethanolamine-N-[methoxy(polyethylene glycol)-2000]
dsRNA	double-stranded RNA
DT-DTPA	dithiolated diethylenetriamine pentaacetic acid
DTPA	diethylentriaminepentaacetic dianhydride
DV	dengue virus
EGF	epidermal growth factor
EGFR	epidermal growth factor receptor
EMA	European Medicines Agency
EOEOVE-ODVE	poly[2-(2-ethoxy) ethoxyethyl vinyl ether-block-octadecyl vinyl ether]
EPR	enhanced permeability and retention

f-CNT	functional CNT
FA	folic acid
FA-ICG//RAPA-TSL	RAPA-loaded and folate-conjugated ICG TSL
FCC	face-centered cubic
FRET	fluorescence resonance energy transfer
FTIR	Fourier-transform infrared spectroscopy
G−	Gram-negative species
G+	Gram-positive bacteria
GCSCs	gastric cancer stem cells
Gd	gadolinium
GD	gramicidin
Gd-nanoLE	Gd-containing lipidenanoemulsion
GDS	gene delivery system
GFN	graphene nanoparticle
GFP	green fluorescent protein
GI	gastrointestinal
GL-COO-β-CD/CA	graphene-β-cyclodextrin/chlorhexidine acetate
GNCgs	gold nanocages
GNP	gold nanoparticle
GNPs/AuNPs	gold nanoparticles
GNR	gold nanorods
GO	graphene oxide
GQD	graphene quantum dot
GrO	reduced graphene oxide
GSH	glutathione
HA	hyaluronic acid
HbF	fetal hemoglobin
HBsAg	hepatitis B surface antigen
HGNS	hollow gold nanosphere
His-co-Phe	poly(histidine)-co-phenylalanine-b-PEG
hMSC	human mesenchymal stem cell
HNE	human neutrophil elastase
HPMA	N-(2-hydroxypropyl) methacrylamide
HSPC	hydrogenated L-α-phosphatidylcholine
HUVEC	human umbilical vein endothelial cells
ICG	indocyanine green
IFNγ	interferon γ
INH	isoniazid

iRGD	internalized RGD
iRGD-ICG-LPs	iRGD-modified ICG liposomes
IT	itraconazole
ITO	indium tin oxide
IUV	unilamellar vesicles
IV	intravenous
KET	ketoconazole
LCST	lower critical solution temperature
LDC	lipid drug conjugate
LDH	lactate dehydrogenase
LET	linear energy transfer
LP	lipid peroxidation
LSPR	localized surface plasmon resonance
LUV	large unilamellar vesicles
MCT	medium-chain triglyceride
MDA	malondialdehyde
MDR	multidrug resistance
MDR-TB	multidrug-resistant TB
miRNA	micro-RNA
MLV	multilamellar vesicles
MMP	matrix-metalloproteinases
MMP-2	matrix metalloproteinase-2
MMP-14	matrix metalloproteinase-14
MPEG-SS-PLA	redox-responsive PEG-b-poly (lactic acid)
MPS	mononuclear phagocyte system
MRC	Medical Research Council
MRI	magnetic resonance imaging
MSN	mesoporous silica
MSOT	multispectral optoacoustic tomography
MSP-119	merozoite surface protein-119
MVV	multivesicular vesicles
MWCN	multiple-walled carbon nanotube
NCs	nanoconjugates
NECT	eflornithine/nifurtimox combination therapy
NGO	nanoscale GO
NIR	near-infrared
NLC	nanostructured lipid carrier
NPs	nanoparticles

NRF	National Research Foundation
NSCLC	non-small-cell lung carcinoma
NSs	nanosystems
NTD	neglected tropical disease
OASIS	Organic and Sustainable Industry Standards
ODN	oligonucleotides
p(OEGMA-co-MEMA)	poly(oligo(ethylene oxide) methacrylate-co-2-(2-methoxyethoxy)ethyl methacrylate)
P-gp	P-glycoprotein
PAA	poly(acrylic acid)
PAA	polyamidoamines
PbAE	poly(β-amino esters)
PBS	phosphate-buffered saline
PC	cyclophosphamide
PC	phosphatidylcholine
PC-12	pheochromocytoma-derived
PC-Chol-SSG	SSG-loaded PC-cholesterol liposomes
PC-SA-SSG	SSG-loaded phosphatidylcholine stearylamine liposomes
PCL	PEG-b-polycaprolactone
PCL-SSPEEP	copolymer of PCL and poly (ethylethylene phosphate)
PCMX	parachlorometaxylenol
PD	Parkinson's disease
pDNA	plasmid DNA
PDT	photodynamic therapy
PEG	polyethylene glycol
PEG-b-PBD	PEG-b-poly (butadiene)
PEG-b-PLA	poly(ethylene glycol) with poly(lactic acid)
PEG-b-PPO-b-PEG	polyethylene glycol-b-polypropylene oxide-b-polyethylene glycol
PEI	polyethylenimine
PEO-b-PMABC	poly(ethyleneoxide)-b-poly {N-methacryloyl-N-(t-butyloxycarbonyl)cystamine}
PEO-PbAE	PEO-modified PbAE
PERL	polyunsaturated ER-targeting liposome
PF-DNA	proton-fueled DNA
PGA	poly(glutamic acid)

PG-b-PCL	poly(glycidol-block-ε-caprolactone)
PIT	phase inversion temperature
PLA	poly(dl-lactide)
PLA	polylactides
PLG	poly(lactideco-glycolide)
PLGA	poly(d,l-lactide-co-glycolide)
PLL	poly-L-lysine
PM-MTH	mithramycin encapsulated in polymeric micelles
PMA	poly(methacrylic acid)
PMMA	PZQ in poly(methyl methacrylate)
pNIPAAm	poly(N-isopropylacrylamide)
PNP	polymeric nanoparticle
PNP	RSV-encapsulated lipid nanoparticle
PPa	pyropheophorbide-a
PPEI-EI	poly(propionylethyleneimine-coethyleneimine)
PPI	polypropylenimine
PQP	piperaquine
pri-miRNA	primary miRNA
PSs	photosensitizers
PSS	poly(sodium 4-styrene sulfonate)
pTAT	polypeptide derived from the transactivator of transcription
PTT	photothermal therapy
PTX	paclitaxel
PVA	poly(vinyl alcohol)
PVA	polyvinyl acrylonitrile
PVA-R	polyvinyl alcohol conjugated hydrophobic anchors
PVK	poly-N-vinyl carbazole
PVP	poly(vinylpyrrolidone)
PZA	pyrazinamide
PZQ	praziquantel
QD	quantum dots
QN	quinine
RAPA	anti-angiogenesis agent rapamycin
rb	Bohr's radius
RBCs	red blood cells
RCPN	Research Center for Pharmaceutical Nanotechnology
RGD	arginine-glycine-aspartate

RGD-GNR	RGD peptides-conjugated GNRs
rGO	reduced graphene oxide
rGO-GNRVe	rGO-loaded ultrasmall plasmonic GNR vesicles
RIF	rifampicin
RISC	RNA-induced silencing complex
RNA	ribonucleic acid
RNAi	RNA interference
ROS	reactive oxygen species
RSV	resveratrol
SA	stearylamine
SC	stratum corneum
SDBS	sodium dodecyl benzene sulfonate
SDS	sodium dodecyl sulfate
SDS-PAGE	sodium dodecyl sulphate polyacryl amide gel electrophoresis
SEM	scanning electron microscope/microscopy
shRNA	short hairpin RNA
siRNA	small interfering RNA
SLN	solid lipid nanoparticle
SPIONs	superparamagnetic iron oxide nanoparticles
SPN	solid lipid nanoparticle
SPR	surface plasmon resonance
SRD	sustained release system
SRN	stimuli-responsive nanocarrier
ssDNA	single-stranded DNA
SSG	sodium stibogluconate
ssLips	submicron-sized liposomes
STEM	scanning electron transmission microscopy
STM	scanning tunneling microscope
STS	scanning tunneling spectroscopy
SUV	small unilamellar vesicles
SWCN	single-walled carbon nanotube
SWCNT	single-wall carbon nanotubes
TAT	transactivator of transcription
TCPS	tissue culture polystyrene substrates
TEM	transmission electron microscope/microscopy
TGA	thermogravimetric analysis
THF	tetrahydrofuran

THSTI	Translational Health Science & Technology Institute
TME	tumor microenvironment
TNBC	triple-negative breast cancer
TPGS	polyethylene glycol-succinate
Trp	l-tryptophan
TSL	thermal sensitive liposome
TZB	trastuzumab
TZB-GNP-^{111}In	^{111}In-labeled TZB-modified GNP
US FDA	United States Food and Drug Administration
UV	ultraviolet
VL	visceral leishmaniasis
WHO	World Health Organization
XRD	X-ray diffraction

PREFACE

The association of medicine and mankind is age old. There has been a constant evolution in treatment strategies aimed at curing the variety of ailments. Academicians as well researchers from industry have yielded many viable formulations that are being used as drug carriers. However, the conventional dosage forms suffer from a few pitfalls, such as non-specific drug delivery, dose dumping, poor patient compliance, toxicities linked with higher doses, etc. The past several decades have witnessed an emergence of nanotechnology-based products. Nanotechnology has been observed to uplift the level of sophistication through a variety of ways. Its uses embrace material science, engineering, medical, dentistry, drug delivery, etc.

In light of the drug delivery context, the present book is an attempt to provide the requisite information to its readers. The content of this book has been written by highly skilled, experienced, and renowned scientists and researchers from all over the world. They provide updated knowledge and drug delivery information to readers, researchers, academicians, scientists, and industrialists around the globe.

Nanoconjugate Nanocarriers for Drug Delivery comprises 16 chapters divided into 4 sections that present an introduction of nanocarriers, physicochemical features, and generalized and specific applications dealing with drug delivery in particular. The materials used as well as formulation and characterization have been discussed in detail. The nanocarriers covered are nanoparticles, vesicular carriers, carriers having carbon as core constituent, dispersed systems, etc.

SECTION I: INTRODUCTION TO NANOCARRIERS

Chapter 1, written by *B. A. Aderibigbe,* provides an overview of different nanobiomaterials used for delivery of drug molecules. The nanobiomaterials are further classified as polymeric, metallic, and derived from carbon. The author has summarized the nanobiomaterials with their striking features.

Chapter 2, written by *M. Pilar Vinardell* and *colleagues,* describes to what extent the surfactants are essential for preparation of numerous drug delivery systems. The chapter begins with a brief preamble of nanotechnolgy followed by classification of surfactants. The discussion of different polymeric and lipidic nanoparticles is provided in ensuing sections. In addition, the chapter covers delivery systems meant via various routes of application containing surfactants. Interestingly, there is mention of utility of surfactant-based nanocarriers in cancer chemotherapy.

The details of general principles and methods of preparation of smart nanoconjugates have been presented in Chapter 3, written by *Subham Banerjee* and *Jonathan Pillai*. The authors have reviewed various therapeutic applications of such stimuli-responsive systems in brief. Finally, the authors conclude with mentioning future perspectives on the therapeutic uses of smart polymeric nanocarriers.

Chapter 4, written by *Ayuob Aghanejad* and *colleagues,* gives an exhaustive description of gold nanoparticles, beginning with introduction going across various synthesis methods and applications in different fields. Further, smart gold nanopartculates are mentioned with relevance to cancer and gene delivery.

SECTION II: VESICLE-BASED DRUG CARRIERS

Different aspects of drug delivery via vesicular nanocarriers are described in Chapter 5, written by *Sanja Petrović* and *colleagues*. The authors have given an overview of the delivery systems that represent multifunction carriers of active substances for controlled, delayed, and targeted drug substance delivery, with a special review of the vesicular drug carriers. The liposomes have been the key formulations with an elaborated discussion.

Chapter 6, written by *Preethi Naik* and *Mangal S. Nagarsenker,* deals with issues related to biological systems in particular. The authors have strived to provide information about different attempts for improving intracellular delivery of siRNA, with special focus on excipient-driven liposomal nanocarrier systems, clinical relevance of siRNA delivery vehicles, and the toxicity concerns associated with such carrier systems. In addition, the toxicity and clinical perspectives of liposomal delivery for siRNA have been discussed.