Drug delivery remains a challenge in management of cancer. Approximately 12.5 million new cases of cancer are being diagnosed worldwide each year and considerable research is in progress for drug discovery for cancer. Cancer drug delivery is no longer simply wrapping up cancer drugs in a new formulations for different routes of delivery. The focus is on targeted cancer therapy. The newer approaches to cancer treatment not only supplement the conventional chemotherapy and radiotherapy but also prevent damage to normal tissues and prevent drug resistance.

Innovative cancer therapies are based on current concepts of molecular biology of cancer. These include antiangiogenic agents, immunotherapy, bacterial agents, viral oncolysis, targeting of cyclic-dependent kinases and tyrosine kinase receptors, antisense approaches, gene therapy and combination of various methods. Important methods of immunotherapy in cancer involve use of cytokines, monoclonal antibodies, cancer vaccines and immunogene therapy.

Several innovative methods of drug delivery are used in cancer. These include use of microparticles as carriers of anticancer agents. These may be injected into the arterial circulation and guided to the tumor by magnetic field for targeted drug delivery. Polyethylene glycol (PEG) technology has been used to overcome some of the barriers to anticancer drug delivery. Encapsulating anticancer drugs in liposomes enables targeted drug delivery to tumor tissues and prevents damage to the normal surrounding tissues. Monoclonal antibodies can be used for the delivery of anticancer payloads such as radionucleotides, toxins and chemotherapeutic agents to the tumors.

Antisense oligonucleotides have been in clinical trials for cancer for some time now. RNAi has also been applied in oncology. Small interfering RNAs (siRNAs) can be targeted to tumors and one example is suppression of H-ras gene expression indicating the potential for application in therapy of ovarian cancer. Cancer gene therapy is a sophisticated form of drug delivery for cancer. Various technologies and companies developing them are described. Nucleic acid-based cancer vaccines are also described.

Drug delivery strategies vary according to the type and location of cancer. Role of drug delivery in the management of cancers of the brain, the bladder, the breast, the ovaries and the prostate are used as examples to illustrate different approaches both experimental and clinical. Biodegradable implants of carmustine are already used in the treatment of malignant brain tumors.

The market value of drug delivery technologies and the anticancer drugs are difficult to separate. Cancer market estimates from 2015-2025 are given according to organs involved and the types of cancer as well as according to technologies. Distribution of the into major regions is also described.

Profiles of 230 companies involved in developing innovative cancer therapies and methods of delivery are presented along with their 268 collaborations. The bibliography contains over 650 publications that are cited in the report. The report is supplemented with 66 tables and 11 figures.
Chromosomes and cancer
Aneuploidy
Chromosomal instability
Telomeres and cancer
Genes and cancer
Accumulation of random mutations
Oncogenes
Role of Bub 1 gene in cell division
Tumor Suppressor Genes
Hallmarks of cancer
Invasion and metastases
Tumor suppressor genes and metastases
Methylation and cancer
Oxidative stress and cancer
RNA and cancer
Anticancer treatments based on RNA regulation of genes
Role of microRNAs in cancer
Stem cells and cancer
Self-sufficiency of tumor proliferation
Therapeutic implications of apoptosis in cancer
Tumor angiogenesis
Cancer biomarkers
Molecular imaging of cancer
Cancer genomics
Gene expression profiling in cancer
Cancer proteomics
Limitations of genomics and proteomics for understanding cancer
Cancer microenvironment
Epidemiology of cancer
Current management of cancer
Anticancer drugs
Limitations of cancer chemotherapy
Biological therapies for cancer
Radiotherapy
Brachytherapy
Ideal anticancer agent
Surgery
Basics of drug delivery in cancer
Role of mechanical forces in tumor growth and delivery of therapy
Methods of assessing drug delivery in cancer
Positron emission tomography (PET)
Historical landmarks in cancer drug delivery

2. Innovative treatments for cancer
Introduction
Selective estrogen receptor modulators
Antiangiogenic strategies for cancer
Development of antiangiogenic therapies
Classification of antiangiogenic agents
Examples of antiangiogenic agents
ACE-041
Angiopoietin-2 as a target
Chemotherapy at lower than maximum tolerated dose
Galectin-3 as a target for inhibiting angiogenesis
Inhibitors of endothelial proliferation
Inducers of apoptosis of endothelial cells of tumor vessels
Lodamin
Matrix metalloproteinase inhibitors
Monoclonal antibodies with vasculostatic properties
PPAR? agonists
Rapalogues as antiangiogenic agents
VEGF Trap
Agents that decrease the permeability of tumor blood vessels
Antiangiogenic agents in clinical trials
Antiangiogenic therapy resistance
Combination of antiangiogenic with cytotoxic therapy
Antiangiogenic therapy for hematological malignancies
Bacterial anticancer agents
Tumor-targeted bacteria
Live bacteria for delivering radioactive anticancer agents
Genetically modified bacteria as anticancer agents
TAPET (Tumor Amplified Protein Expression Therapy)
Bacterial protein for targeted delivery of liposomal cancer drugs
Inactivated but metabolically active bacteria
Bacterial toxins targeted to tumors
Immunotoxins
Escherichia Coli toxins
Engineered anthrax toxin
Recombinant fusion toxins
Type III secretion systems
Induction of apoptosis in cancer by bacterial proteins
Induction of immune response by bacteriolytic therapy
Epigenetic targets for anticancer therapy
Innovations in cell therapy for cancer
Stem cell transplantation for cancer
Cancer drug/gene delivery by mesenchymal stem cells
Cancer immunotherapy
Cytokines
STING activation and antitumor immunity
Cancer vaccines
5T4 as a target for cancer immunotherapy
Adoptive cell therapy
Antigen-specific cancer vaccines
Carcinoembryonic antigen-based vaccines
Carbohydrate-based cancer vaccines
Dendritic cells for cancer vaccination
Hybrid cell vaccination
SMART vaccines
Salmonella-based oral vaccine delivery
Tumor cell vaccines
Vaccines that simultaneously target different cancer antigens
Vaccines based on multiple tumor-associated peptides
Vaccine for cancer based on antimalaria protein
Cancer Vaccine Consortium
Chemimmunotherapy
Concluding remarks about cancer vaccines
Targeted delivery of peptides to tumor-associated macrophages
Targeting cancer stem cells
Monoclonal antibodies
Murine MAbs
Humanized MAbs
Actions and uses of monoclonal antibodies in cancer
Targeted antibody-based cancer therapy
Antibody–cytokine fusion proteins
Antibody J591 for targeted delivery of anticancer therapy
Anti-Thomsen-Friedenreich antigen MAb
Combining MAbs with anti-CD55 antibody
MAbs targeted to alpha fetaprotein receptor
MAbs that target angiogenesis
MAbs for immune activation
Delivery of cancer therapy with MAbs
Antibody-directed enzyme prodrug therapy
Chemically programmed antibodies
Combining diagnostics with therapeutics based on MAbs
Radiolabeled antibodies for detection and targeted therapy of cancer
Other innovations for administration of antibodies
Bispecific antibodies
Trifunctional antibodies
Tetravalent bispecific antibodies
Immunotoxins
Immunoliposomes
Combined use of MAbs and cytokines
huHMFG1-huD Nase I
MAbs that selectively target cancer
NanoMAbs for targeting cancer
Advantages and limitations of MAbs for cancer therapy
Antibody-drug conjugates
Kadcyla
Adcetris
Current status and future trends in antibody-based cancer drugs
Innovative methods of radiation delivery
Image-guided ultrasound technology for delivery of radiation
Respiratory gating technology for radiation therapy
Positron therapy
Boron neutron capture therapy
Application of drug delivery systems to BNCP
Use of nanotechnology to enhance BNCT
Ion channels and transporters in cancer
Irreversible electroporation
Methods to overcome multidrug resistance (MDR)
Mechanism of MDR
MDR-associated protein gene
P-glycoprotein-mediated MDR
Strategies for overcoming MDR
Blocking the action of P-glycoprotein
Combination of targeted drugs with different specificities
Enzyme Catalyzed Therapeutic Activation
Inhibition of DNA repair
Iron chelators that overcomes resistance to chemotherapeutics
Liposome formulation of anticancer drugs
Modification of the chemical structure of the anticancer drug
Managing resistance to antiapoptotic action of anticancer agents
Modulation of SPARC expression
Nitric oxide inducers
Proton pump inhibitors
Repression of Prohibitin1 in drug-resistant cancer cells
Targeted cancer therapies
Targeting cellular pathways
Targeting antigens in virus-associated cancer
Targeting the IGF-I receptor
Targeting Mcl-1 protein
Targeting mitochondrial membranes
Targeting tumor lymphatics
LyP-1 for targeting tumor lymphatics
Targeting tyrosine kinase receptors
Inhibitors of bcr-abl tyrosine kinase
Inhibition of multiple tyrosine kinases
Inhibitors of ErbB tyrosine kinase
Targeting the Hedgehog signaling pathway
Targeting caspase-8
Targeting metallodrugs to tumor cells
Targeting oncogenes
Targeting miRNA for cancer therapeutics
Targeting the transferrin receptor-mediated endocytosis pathway
Targeted anticancer therapies based on the Rad51 promoter
Targeting cancer stem cells
Targeting glycolytic pathway in cancer
Targeting glycoproteins
Tagging cancer with modified sugars
Anticancer agents based on glycobiology
Targeting cell surface glycoproteins
Biofusion for targeted cancer therapy
Targeting knottin peptides
Enhancing the effects of radiation and chemotherapy
Sensitizing and enhancing agents for chemotherapy
CoFactor to enhance the efficacy of chemotherapy
Enzyme-enhanced chemotherapy
Resveratrol and quercetin for cardioprotection against chemotherapy
Tesmilifene for chemosensitization
Sensitizing agents for radiotherapy
iPdR
Ultrasound for enhancing response to radiation
Manipulation of tumor oxygenation
Hypoxia-based methods to enhance chemotherapy and radiotherapy
Hyperbaric oxygen and radiation
HIF-1 antagonists to enhance radiotherapy
Nonsteroidal antiinflammatory drugs enhance tumor radiosensitivity
ONCONASE as radiosensitivity enhancer
Hyperthermia and chemotherapy/radiation therapy
Techniques for hyperthermia
Trimodality therapy: radiation, chemotherapy, and hyperthermia
Photodynamic therapy
Novel anticancer agents
Anti-EphA2 antibodies
Antioxidants
Brostallicin
Agents disrupting folate metabolism
Pemetrexed
Cell cycle inhibitors
Cytotoxic ribonucleases
DNA hypomethylating agents
Histone-based cancer therapy
Histone deacetylase inhibitors
Modulation of p300/CBP histone acetyltransferase activity
Simulation of endogenous histone for anticancer therapy
HSP90 inhibitors
Ion channel blockers
IOT-101
Endovion
LPAAT-ß inhibitors
Modulation of pyruvate kinase M2
P13-kinase inhibitors
PARP inhibitors
Targeted destruction of BRCA2 deficient tumors by PARP inhibitors
Prodrugs
Enzyme-activated prodrugs
Ascorbic acid as a prodrug for cancer
Polarix
Procaspe-3 activation
Protein kinase G activation
Proteasome inhibitors
Recombinant human insulin-like growth factor binding protein-3
Second generation nucleosides
Targeting cancer metabolism
Targeting topoisomerase IB
Telomerase inhibitors
Therapeutic strategies based on the P53 pathway
Therapeutic strategies based on molecular mechanisms
Checkpoint activation as a strategy against cancer
Deletion-specific targeting for cancer therapy
In vivo models for molecularly anticancer drugs
Repair-blocking drugs for enhancing effect of chemotherapy
Tumor targeting fields
Targeting mTOR signaling defects
Combining novel anticancer approaches
Personalized therapy of cancer
Challenges of cancer classification
Design of future cancer therapies
Personalized drug development in oncology
Role of molecular imaging
Role of molecular imaging in targeted cancer therapy
Screening for personalized anticancer drugs
Targeting pathways for personalized cancer therapy

3. Drug delivery systems for cancer
Introduction
Routes of drug delivery in cancer
Intravenous delivery systems for cancer therapy
Intravenous versus oral ascorbate for treatment of cancer
Subcutaneous injection of anticancer agents
Oral delivery of anticancer agents
Oral UFT
5-FU combined with eniluracil
Oral paclitaxel
Oral fluoropyrimidines
Oral satraplatin
Oral PXD101
ARRY-142886
High dose pulse administration of calcitrol
Oral gefitinib vs intravenous docetaxel
Transdermal drug delivery
Delivery of the photosensitizer drug d-amino levulinic acid
Nanoemulsion-based delivery of caffeine for skin cancer
Transdermal delivery of methotrexate
Transdermal nitroglycerine for prostate cancer
Transdermal delivery of peptide cancer vaccines
Intradermal delivery of cancer vaccines by adenoviral vectors
Pulmonary delivery of anticancer agents
Regional intra-arterial delivery of chemotherapy
Gas embolotherapy of tumors
Drug delivery to lymph nodes
Intraperitoneal macrophages as drug delivery vehicle
Challenges of cancer drug delivery
Tumor blood vessel pore barrier to drug delivery
Improvement of drug transport in tumors
Delivery of anticancer drugs to nuclear targets
Innovative formulations for drug delivery in cancer
Cancer targeting with polymeric drugs
Linking anticancer drugs to polyglutamate
Improving delivery of protein-polymer anticancer drugs
Macromolecules as delivery systems for taxanes
Polyamine conjugates as anticancer agents
Bacterial vectors as drug delivery systems for anticancer drugs
Microparticles as therapeutic delivery systems in cancer
Subcutaneous injection of microspheres carrying anticancer drugs
Intravascular delivery systems using microparticles
Tumor embolization with drug-eluting beads
Tumor embolization with radioactive microparticles
Microparticles heated by magnetic field
Magnetic targeted microparticle technology
Release of drugs from biSphere by ultrasound
Release of drugs from micelles by ultrasound
Release of drugs from microcapsules by laser
Chemoembolization
Anticancer drugs bound to carbon particles
Anticancer drugs bound to protein microspheres
Nanoerythrosomes
Micronized droplets of olive oil
Nanobiotechnology-based drug delivery for cancer
Nanoparticle formulations for drug delivery in cancer
Anticancer drug particles incorporated in liposomes
Doxorubicin nanocarriers
Encapsulating drugs in hydrogel nanoparticles
Exosomes
Folate-linked nanoparticles
Lipid based nanocarriers
Micelles for drug delivery in cancer
Minicells for targeted delivery of nanoscale anticancer therapeutics
Nanobombs for cancer
Nanodiamonds for local delivery of chemotherapy at site of cancer
Nanoparticle formulation for enhancing anticancer efficacy of cisplatin
Nanoparticle formulations of paclitaxel
Nanoparticles containing albumin and antisense oligonucleotides
Nanotechnology-based non-invasive refilling of drug delivery depots
Non-aggregating nanoparticles
Pegylated nanoliposomal formulation
Perfluorocarbon nanoparticles
Protosphere nanoparticle technology
Nanoparticles-based targeted delivery of therapeutics for cancer
Antiangiogenic therapy using nanoparticles
Carbon magnetic nanoparticles for targeted drug delivery in cancer
Carbon nanotubes for targeted drug delivery to cancer cells
DNA aptamer-micelle for targeted drug delivery in cancer
Fullerenes for enhancing tumor targeting by antibodies
Gold nanoparticles for targeted drug delivery in cancer
Iron oxide magnetic nanoparticle formulation for drug delivery
Lipoprotein nanoparticles targeted to cancer-associated receptors
Magnetic nanoparticles for remote-controlled drug delivery to tumors
Nanobees for targeted delivery of cytolytic peptide melittin
Nanocell for targeted drug delivery to tumor
Nanodroplets for site-specific cancer treatment
Nanogel-based stealth cancer vaccine targeting macrophages
Nanoparticle-mediated targeted delivery of peptides into tumors
Nanoparticle-mediated targeting of MAPK signaling pathway
Nanoparticles for targeted delivery of concurrent chemoradiation
Nanostructured hyaluronic acid for targeted drug delivery in cancer
Nanoparticles as antibody-drug conjugates
Nanoparticle-coated peptides for tumor targeting
Nanoparticle-mediated delivery of multiple anticancer agents
Polymer nanoparticles for targeted drug delivery in cancer
Polymersomes for targeted cancer drug delivery
Targeted drug delivery with nanoparticle-aptamer bioconjugates
Targeted nanoparticles delivery of cisplatin to mitochondrial genome
Time-delayed, dual-drug nanoparticle delivery system for cancer
Dendrimers for anticancer drug delivery
Application of dendrimers in boron neutron capture therapy
Application of dendrimers in photodynamic therapy
Dendrimer-based synthetic vector for targeted cancer gene therapy
Devices for nanotechnology-based cancer therapy
Convection-enhanced delivery with nanoliposomal CPT-11
Nanocomposite devices
Nanoengineered silicon for brachytherapy
Nanosensors for targeted drug delivery in cancer
Nanoparticles combined with physical agents for tumor ablation
Carbon nanotubes for laser-induced cancer destruction
Nanoparticles and thermal ablation
Nanoparticles combined with ultrasound radiation of tumors
Nanoparticles as adjuncts to photodynamic therapy of cancer
Nanoparticles for boron neutron capture therapy
RNA nanotechnology for delivery of cancer therapeutics
Nanocarriers for simultaneous delivery of multiple anticancer agents
Combination delivery systems for nanoparticle penetration into tumor tissue
Combination of diagnostics and therapeutics for cancer
Biomimetic nanoparticles targeted to tumors
Dendrimer nanoparticles for targeting and imaging tumors
Gold nanoparticle plus bombesin for imaging and therapy of cancer
Gold nanorods for diagnosis plus photothermal therapy of cancer
Magnetic nanoparticles for imaging as well as therapy of cancer
NanoBialys for combining MRI with delivery of anticancer agents
pHLIP nanotechnology for detection and targeted therapy of cancer
Polymer nanobubbles for targeted and controlled drug delivery
Radiolabeled carbon nanotubes for tumor imaging and targeting
Targeted therapy with magnetic nanomaterials guided by antibodies
Ultrasound tumor imaging and targeted chemotherapy by nanobubbles
Future prospects of nanobiotechnology and targeted cancer therapy
Polyethylene glycol technology
Enzon’s PEG technology
Debiopharm’s PEG biconjugate drug delivery platform
Nektar PEGylation
PEG Intron
Single-chain antibody-binding protein technology
Vesicular systems for drug delivery in cancer
Liposomes for anticancer drug delivery
Antibody-targeted liposomes for cancer therapy
ALZA’s Stealth liposomes
Boron-containing liposomes
DepoFoam technology
Hyperthermia and liposomal drug delivery
Liposomal doxorubicin formulation with N-octanoyl-glucosylceramide
Liposome-nucleic acid complexes for anticancer drug delivery
Non-pegylated liposomal doxorubicin
Tumor-selective targeted drug delivery via folate-PEG liposomes
Ultrasound-mediated anticancer drug release from liposomes
Companies developing liposome-based anticancer drugs
Pharmacosomes for controlled anticancer drug delivery
Emulsion formulations of anticancer drugs
Albumin-based drug carriers
Anticancer drugs that bind to tumors
Monoclonal T cell receptor technology
Radioactive materials for diagnosis and targeted therapy of cancer
Peptide receptor radionuclide therapy
Pretargeted radioimmunotherapy of cancer
Radiolabeled somatostatin receptor antagonists
Theophylline enhances radioiodide uptake by cancer
Strategies for drug delivery in cancer
Direct introduction of anticancer drugs into the tumor
Injection into the tumor
Antineoplastic drug implants into tumors
Tumor necrosis therapy
Injection into the arterial blood supply of cancer
Electrochemotherapy
Pressure-induced filtration of drugs across vessels to the tumor
Improving drug transport to tumors
Carbohydrate-enhanced chemotherapy
Dextran as macromolecular anticancer drug carriers
In situ production of anticancer agents in tumors
Strategies for increasing drug penetration into solid cancers
Selective destruction of cancer cells
Sphingolipids
Hyperbaric oxygen
Targeting response to transformation-induced oxidative stress
Targeting enzymes to prevent proliferation of cancer cells
Targeted drug delivery in cancer
Affibody molecules for targeted anticancer therapy
Fatty acids as targeting vectors
Genetic targeting of the kinase activity in cancer cells
Heat-activated targeted drug delivery
Novel transporters to target photosensitizers to cancer cell nuclei
Photodynamic therapy of cancer
Radionuclides delivered with receptor targeting technology
Targeting ligands specific for cancer cells
Targeting abnormal DNA in cancer cells
Targeted delivery by tumor-activated prodrug therapy
Targeting glutathione S-transferase
Targeting tumors by exploiting leaky blood vessels
Targeted drug delivery of anticancer agents with controlled activation
Targeted delivery of anticancer agents with ReCODE™ technology
Transmembrane Carrier Systems
Transferrin-oligomers as targeting carriers in anticancer drug delivery
Tumor targeting with peptides
Ultrasound and microbubbles for targeted anticancer drug delivery
Ultrasound for targeted delivery of chemotherapeutics
Vitamin B12 and folate for targeting cancer chemotherapy
Cell-based drug delivery in cancer
Red blood cells as vehicles for drug delivery
Cells as vehicles for gene delivery
Drug delivery in relation to circadian rhythms
Implants for systemic delivery of anticancer drugs
Drug-eluting polymer implants
Angiogenesis and drug delivery to tumors
Antiangiogenesis strategies
Targeting tumor endothelial cells
Methods for overcoming limitations of antiangiogenesis approaches
Vascular targeting agents
Alpha-emitting antibodies for vascular targeting
Angiolytic therapy
Anti-phosphatidylserine antibodies as VTA
Vadimezan
Cadherin inhibitors
Fosbretabulin tromethamine
Drugs to induce clotting in tumor vessels
Selective permeation of the anticancer agent into the tumor
Targeted delivery of tissue factor
Vascular targeting agents versus antiangiogenesis agents
ZD6126
Delivery of proteins and peptides for cancer therapy
CELLECTRA™ electroporation device
Emisphere’s Eligen™ system
Diatos Peptide Vector intra-cellular/intra-nuclear delivery technology
Lytic peptides and cancer
Modification of proteins and peptides with polymers
Peptide-based targeting of cancer biomarkers for drug delivery
Peptide-cytokine complexes as vascular targeting agents
Peptide-polymer conjugates with radionuclides
Transduction of proteins in vivo
Tumor targeting by stable toxin (ST) peptides
Image-guided personalized drug delivery in cancer
A computational approach to integration of drug delivery methods for cancer

4. Delivery of Biological Therapies for Cancer
Introduction
Antisense therapy
Basics of antisense approaches
Antisense cancer therapy
Mechanisms of anticancer effect of antisense oligonucleotides
Selected antisense drugs in development for cancer
Antisense targeted to ribonucleotide reductase
Immune modulatory oligonucleotide
Ribozyme therapy
Spiegelmers
Antisense drug delivery issues
Strategies to overcome delivery problems of antisense oligonucleotides
Antisense delivery in microspheres
Delivery of antisense using nanoparticles
Delivery across the blood-brain barrier
Delivery of ribozymes
Iontophoretic delivery of oligonucleotides
Liposomes-mediated oligonucleotide delivery
Neugene? antisense drugs
Oral delivery of oligonucleotides
Peptide nucleic acid delivery
Receptor-mediated endocytosis
Delivery of ribozymes
Combination of antisense and electrochemotherapy
Aptamers for combined diagnosis and therapeutics of cancer
Antisense compounds in clinical trials
RNA interference
Basics of RNAi
Comparison of antisense and RNAi
RNAi applications in oncology
siRNA-based cancer immunotherapy
Delivery of siRNA in cancer
Delivery of siRNA by nanoparticles
Delivery of siRNA by nanosize liposomes
Lipid nanoparticles for delivery of anticancer siRNAs
Polymer nanoparticles for targeted delivery of anticancer siRNA
Companies developing cancer therapies based on antisense and RNAi
DNA interference
Cancer gene therapy
Basics of gene therapy
Strategies for cancer gene therapy
Gene transfer techniques as applied to cancer gene therapy
Viral vectors
Nonviral vectors
A polymer approach to gene therapy for cancer
Direct gene delivery to the tumor
Injection into tumor
Reversible electroporation
Hematopoietic gene transfer
Genetic modification of human hematopoietic stem cells
Gene-based strategies for immunotherapy of cancer (immunogene therapy)
Cytokine gene therapy
Monoclonal antibody gene transfer
Transfer and expression of intracellular adhesion-1 molecules
Other gene-based techniques of immunotherapy of cancer
Fas (Apo-1)
Chemokines
Major Histocompatibility Complex (MHC) Class I
IGF (Insulin-Like Growth Factor)
Inhibition of immunosuppressive function
microRNA gene therapy
Delivery of toxic genes to tumor cells for eradication (molecular chemotherapy)
Gene-directed enzyme prodrug therapy
Combination of gene therapy with radiotherapy
Multipronged therapy of cancer with microencapsulated cells
Correction of genetic defects in cancer cells (mutation compensation)
Targeted gene therapy for cancer
Transcriptional targeting for cancer gene therapy
Targeted epidermal growth factor-mediated DNA delivery
Gene-based targeted drug delivery to tumors
Targeting gene expression to hypoxic tumor cells
Targeting gene expression by progression-elevated gene-3 promoter
Targeted delivery of retroviral particles hitchhiking on T cells
Targeting tumors with genetically modified T cells
Targeting tumors by genetically engineered stem cells
Tumor-targeted gene therapy by receptor-mediated endocytosis
Targeted site-specific delivery of anticancer genes by nanoparticles
Immunolipoplex for delivery of p53 gene
Combination of electrogene and electrochemotherapy
Virus-mediated oncolysis
Targeted cancer treatments based on oncolytic viruses
Oncolytic gene therapy
Cytokine-induced killer cells for delivery of an oncolytic virus
Facilitating oncolysis by targeting innate antiviral response by HDIs
Oncolytic HSV
Oncolytic adenoviruses
Oncolytic Coxsackie virus A21
Oncolytic vesicular stomatitis virus
Oncolytic measles virus
Oncolytic paramyxovirus
Oncolytic reovirus
Oncolytic vaccinia virus
Cancer terminator virus
Monitoring of viral-mediated oncolysis by PET
Companies developing oncolytic viruses
Antiangiogenic therapy for cancer
Apoptotic approach to improve cancer gene therapy
Bacteria as novel anticancer gene vectors
Concluding remarks on cancer gene therapy
Cancer gene therapy companies
Cell therapy for cancer
Cellular immunotherapy for cancer
Treatments for cancer by ex vivo mobilization of immune cells
Granulocytes as anticancer agents
Neutrophil granulocytes in antibody-based immunotherapy of cancer
Use of hematopoietic stem cells for targeted cancer therapy
Cancer vaccines
Cell-based cancer vaccines
Autologous tumor cell vaccines
Vaccines that simultaneously target different cancer antigens
Delivery systems for cell-based cancer vaccines
Intra-lymph node injections of cancer vaccine antigens
Nucleic acid-based cancer vaccines
DNA cancer vaccines
Antiangiogenic DNA cancer vaccine
Methods of delivery of DNA vaccines
RNA vaccines
Viral vector-based cancer vaccines
Companies involved in nucleic acid-based vaccines
Genetically modified cancer cells vaccines
GVAX cancer vaccines
Genetically modified dendritic cells
Multipeptide-based cancer vaccines

5. Delivery strategies according to cancer type and location
Introduction
Bladder cancer
Intravesical drug delivery
Intravesical agents combined with systemic chemotherapy
Targeted anticancer therapy for bladder cancer
Prodrug EOquin for bladder cancer
Antisense treatment of bladder cancer
Gene therapy for bladder cancer
Brain tumors
Methods for evaluation of anticancer drug penetration into brain tumor
Innovative methods of drug delivery for glioblastoma multiforme
Delivery of anticancer drugs across the blood-brain barrier
Anticancer agents with increased penetration of BBB
BBB disruption
Nanoparticle-based targeted delivery of chemotherapy across the BBB
Tyrosine kinase inhibitor increases topotecan penetration into CNS
Bypassing the BBB by alternative methods of drug delivery
Intranasal perillyl alcohol
Intraarterial chemotherapy
Enhancing tumor permeability to chemotherapy
Local delivery of chemotherapeutic agents into the tumor
Carmustine biodegradable polymer implants
Fibrin glue implants containing anticancer drugs
Biodegradable microspheres containing 5-FU
Magnetically controlled microspheres
Convection-enhanced delivery
CED for receptor-directed cytotoxin therapy
CED of topotecan
CED of a modified diphtheria toxin conjugated to transferrin
CED of nanoliposomal CPT-11
CED for delivery
11-chTNT-1/B MAb
Anticancer drug formulations for targeted delivery to brain tumors
Intravenous delivery of anticancer agents bearing transferrin
Liposomes for drug delivery to brain tumors
MAbs targeted to brain tumors
Multiple targeted drugs for brain tumors
Nanoparticles for targeted drug delivery in glioblastoma multiforme
Targeted angiogenic/apoptotic/cytotoxic therapies
Introduction of the chemotherapeutic agent into the CSF pathways
Intraventricular chemotherapy for meningeal cancer
Intrathecal chemotherapy
Interstitial delivery of dexamethasone for reduction of peritumor edema
Combination of chemotherapy with radiotherapy
Photodynamic therapy for chemosensitization of brain tumors
Nanoparticles for photodynamic therapy of brain tumors
Innovative delivery of radiotherapy to brain tumors
GliaSite Radiation Therapy System
Boron neutron capture therapy for brain tumors
Cell therapy for glioblastoma multiforme
Mesenchymal stem cells to deliver treatment for gliomas
Stem cell-based therapy targeting EGFR in GBM
Gene therapy for glioblastoma multiforme
Antiangiogenic gene therapy
Anticancer drug delivery by genetically engineered MSCs
Gene transfer to brain tumor across the BBB by nanobiotechnology
Intravenous gene delivery with nanoparticles into brain tumors
Ligand-directed delivery of dsRNA molecules targeted to EGFR
Neural stem cells for drug/gene delivery to brain tumors
Peptides targeted to glial tumor cells
RNAi gene therapy of brain cancer
Single-chain antibody-targeted adenoviral vectors
Targeting normal brain cells with an AAV vector encoding interferon-?
Treatment of medulloblastoma by suppressing genes in Shh pathway
Virus-mediated oncolytic therapy of glioblastoma multiforme
Vaccination for glioblastoma multiforme
Cell-based vaccines for GBM
Peptide vaccines for GBM
Breast Cancer
Therapies for breast cancer involving innovative methods of drug delivery
Injectable biodegradable polymer delivery system for local chemotherapy
MammoSite brachytherapy
Monoclonal antibodies targeted to HER2 receptor
Breast cancer vaccines
HER-2 DNA AutoVac? vaccine
Recombinant adenoviral ErbB-2/neu vaccine
Gene vaccine for breast cancer
NeuVax
Gene therapy for breast cancer
Antisense therapy for breast cancer
Inhibitors of growth factors FGF2 and VEGF for breast cancer
Targeted multi-drug delivery approach to breast cancer
Cancer of the cervix and the uterus
Gene therapy for cervical cancer
Delivery of chemoradiation therapy
Cervical cancer vaccines
Colorectal cancer
Perifosine
Oxaliplatin long-circuting liposomes
Cancer of the liver
Hepatocellular carcinoma
Treatment of liver metastases
Gastrointestinal cancer
Gastrointestinal stromal tumor
Hematological malignancies
Leukemia
Clofarabine
Ibrutinib
Idelalisib for CLL
Multiple myeloma
Monoclonal antibody therapy in multiple myeloma
Non-Hodgkin's lymphoma
Idelalisib for NHL
Pixantrone
Malignant melanoma
Targeted therapies for melanoma
Immunotherapy for malignant melanoma
Gene therapy for malignant melanoma
Nasopharangeal carcinoma
Synergistic effect of gene therapy with 5-FU
Neuroblastoma
Genetically modified NSCs for treatment of neuroblastoma
Non-small cell lung cancer
Aerosol delivery of anticancer agents for lung cancer
Aerosol gene delivery for lung cancer
Complex nanoscale pulmonary delivery of drugs for resistant lung cancer
Intratumoral administration of anticancer drugs through a bronchoscope
Ovarian cancer
Innovative drug delivery for ovarian cancer
Intravenous ascorbate for ovarian cancer
Intraperitoneal delivery
Targeting Notch pathway to overcome resistance to chemotherapy
Dendritic cell vaccination for ovarian cancer
Gene Therapy for ovarian cancer
Pancreatic cancer
Delivery of chemotherapy for pancreatic cancer
Local drug delivery
Targeted chemotherapy for pancreatic cancer
Transport properties of pancreatic cancer and gemcitabine delivery
Vaccine for pancreatic cancer
Gene therapy for pancreatic cancer
Correction of altered genes
Targeted gene therapy
Targeting in pancreatic adenocarcinoma with cell surface antigens
Targeted Expression of BikDD gene
Viral oncolysis in pancreatic cancer
Prostate cancer
Alpha emitter radium-223 for targeting bone metastases in cancer
Brachytherapy for cancer of prostate
Brachytherapy via paravertebral approach lymph node metastases
Capridine-beta
LHRH for prostate cancer
LHRH analogs
Histrelin implant
Immunomodulatory drugs
MAbs for prostate cancer
PACLIMER Microspheres
PRX302
Targeted therapies for prostate cancer
Delivery of cisplatin to prostate cancer by nanoparticles
Delivery of siRNAs to prostate cancer with aptamer-siRNA chimeras
Delivery of siRNA for prostate cancer with metastases
Gold nanoparticles targeted to laminin receptor in prostate cancer
PSA-activated protoxin that kills prostate cancer
Targeted drug delivery with nanoparticle-aptamer bioconjugates
Targeted delivery of a nanoparticulate platinum prodrug
Targeting oncogene MDM2 in prostate cancer
Vascular targeting of prostate cancer
Gene therapy for cancer of prostate
Experimental studies
Nanoparticle-based gene therapy for prostate cancer
Tumor suppressor gene therapy in prostate cancer
Vaccines for prostate cancer
Clinical trials of gene therapy for prostate cancer
Viral oncolysis for prostate cancer
Combined approaches
Combined autovaccination and hyperthermia
Thyroid cancer

6. Cancer drug delivery markets
Introduction
Global markets for drug delivery
Estimation of cancer drug delivery markets
Methods used for market estimation
Cancer epidemiology
Cost of patient care in cancer
Market forecasts 2015-2025
Cancer drug market
Market for leukemia
Market for lymphoma
Markets for brain tumors
Geographical distribution of cancer markets
Factors affecting future cancer markets
Market share according to cancer drug delivery technologies
Antiangiogenesis therapies
Antineoplastic drug implants for systemic administration
Antisense therapy and RNAi
Cancer vaccines
Cell/gene therapy
Liposomes for anticancer drugs
Monoclonal antibodies
Strategic aspects of cancer drug delivery
Unmet needs in cancer drug delivery
Future prospects of cancer drug delivery
Cancer drug delivery and pharmacogenomics
Drug delivery for cancer in the postgenomic era
Role of nanobiotechnology in development of cancer drug delivery markets
Expansion of cancer drug delivery markets in developing countries
Drivers for the development of drug delivery technologies in cancer

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