Personalized Medicine - Scientific and Commercial Aspects

Description: The aim of personalized medicine or individualized treatment is to match the right drug to the right patient and, in some cases, even to design the appropriate treatment for a patient according to his/her genotype. This report describes the latest concepts of development of personalized medicine based on pharmacogenomics, pharmacogenetics, pharmacoproteomics, and metabolomics. Basic technologies of molecular diagnostics play an important role, particularly those for single nucleotide polymorphism (SNP) genotyping. Biomarkers play an important role in personalized medicine. Diagnosis is integrated with therapy for selection of treatment as well for monitoring the results. There is emphasis on early detection and prevention of disease in modern medicine. Biochip/microarray technologies and next generation sequencing are also important. The concept of personalized medicine described in this report remains the best way to integrate new technologies such as nanobiotechnology for improving healthcare. Finally bioinformatics is needed to analyze the immense amount of data generated by various technologies.

Pharmacogenetics, the study of influence of genetic factors on drug action and metabolism, is used for predicting adverse reactions of drugs. Several enzymes are involved in drug metabolism of which the most important ones are those belonging to the family of cytochrome P450. The knowledge of the effects of polymorphisms of genes for the enzymes is applied in drug discovery and development as well as in clinical use of drugs. Cost-effective methods for genotyping are being developed and it would be desirable to include this information in the patient's record for the guidance of the physician to individualize the treatment. Pharmacogenomics, a term that overlaps with pharmacogenetics but is distinct, deals with the application of genomics to drug discovery and development. It involves the mechanism of action of drugs on cells as revealed by gene expression patterns. Pharmacoproteomics is an important contribution to personalized medicine as it is a more functional representation of patient-to-patient variation than that provided by genotyping. A 'pharmacometabonomic' approach to personalizing drug treatment is also described.

Biological therapies such as those which use patient's own cells are considered to be personalized medicines. Vaccines are prepared from individual patient's tumor cells. Individualized therapeutic strategies using monoclonal bodies can be directed at specific genetic and immunologic targets. Ex vivo gene therapy involves the genetic modification of the patient's cells in vitro, prior to reimplantation of these cells in the patient's body.

Various technologies are integrated to develop personalized therapies for specific therapeutic areas described in the report. Examples of this are genotyping for drug resistance in HIV infection, personalized therapy of cancer, antipsychotics for schizophrenia, antidepressant therapy, antihypertensive therapy and personalized approach to neurological disorders. Although genotyping is not yet a part of clinically accepted routine, it is expected to have this status by the year 2020.

Several players are involved in the development of personalized therapy. Pharmaceutical and biotechnology companies have taken a leading role in this venture in keeping with their future role as healthcare enterprises rather than mere developers of technologies and manufacturers of medicines.

Ethical issues are involved in the development of personalized medicine mainly in the area of genetic testing. These along with social issues and consideration of race in the development of personalized medicine are discussed. Regulatory issues are discussed mainly with reference to the FDA guidelines on pharmacogenomics.

Increase in efficacy and safety of treatment by individualizing it has benefits in financial terms. Information is presented to show that personalized medicine will be cost-effective in healthcare systems. For the pharmaceutical companies, segmentation of the market may not leave room for conventional blockbusters but smaller and exclusive markets for personalized medicines would be profitable. Marketing opportunities for such a system are described with market estimates from 2015-2025.

Profiles of 316 companies involved in developing technologies for personalized medicines, along with 573 collaborations are included in the part II of the report. Finally the bibliography contains over 750 selected publications cited in the report. The report is supplemented by 77 tables and 31 figures.
Part I: Scientific & Commercial Aspects

0. Executive Summary

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Enzymatic Mutation Detection (EMD)
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High-throughput paired end transcriptome sequencing
Emerging sequencing technologies
4300 DNA analyzer
Apollo 100
"Color blind" approach to DNA sequencing
Cyclic array sequencing
CEQ™ 8000
DeepCAGE sequencing
Electron microscope-based DNA sequencing
Genometrca? sequencer
GS-FLEX system (Roche/454)
IBS sequencing technology
Illumina's sequencing technology
MegaBACE 500
Microdroplet-based PCR for large-scale targeted sequencing
Multiplex amplification of human DNA sequences
Nanoscale sequencing
Polonator sequencer
RainStorm™ microdroplet technology
Sequential DEXAS
SOLiD technology
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Whole genome sequencing
Bioinformatic tools for analysis of genomic sequencing data
Detection of single molecules in real time
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Future prospects of sequencing
Role of DNA sequencing in development of personalized medicine
Role of RNA sequencing in development of personalized medicine
Biochips and microarrays
Role of biochip/microarray technology in personalized medicine
Applications of biochip/microarray technology in personalized medicine
Standardizing the microarrays
Biochip technologies
GeneChip
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LabCD
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Integrated microfluidic bioassay chip
Electronic detection of nucleic acids on microarrays
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ProteinChip
LabChip for protein analysis
TRINECTIN proteome chip
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Microfluidic devices for proteomics-based diagnostics
New developments in protein biochips/microarrays
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Haplootype Specific Extraction
Computation of haplotypes
HapMap project
Haplotyping for whole genome sequencing
Predicting drug response with HapMap
Companies developing haplotyping technology
Technologies for SNP analysis
Biochip and microarray-based detection of SNPs
SNP genotyping by MassARRAY
BeadArray technology
SNP-IT primer-extension technology
Use of NanoChip for detection of SNPs
Electrochemical DNA probes
Laboratory Multiple Analyte Profile
PCR-CTPP (confronting two-pair primers)
TaqMan real-time PCR
Locked nucleic acid
Molecular inversion probe based assays
Pyrosequencing
Smart amplification process version 2
Zinc finger proteins
Mitochondrial SNPs
Limitations of SNP in genetic testing
Concluding remarks on SNP genotyping
Companies involved in developing technologies/products for SNP analysis
Impact of SNPs on personalized medicine
Detection of copy number variations
CNVer algorithm for CNV detection
CNVnator for discovery of CNVs and genotyping
Study of rare variants in pinpointing disease-causing genes
Optical Mapping
Proteomics in molecular diagnosis
Proteomic strategies for biomarker identification
Proteomic technologies for detection of biomarkers in body fluids
Protein patterns
Layered Gene Scanning
Comparison of proteomic and genomic approaches in personalized medicine
Role of nanobiotechnology in molecular diagnostics
Cantilevers for personalized medical diagnostics
Role of biomarkers in personalized medicine
Role of biosensors in personalized medicine
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Biomarkers for drug development
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DNA microarrays
Analysis of single-cell gene expression
Gene expression profiling based on alternative RNA splicing
Whole genome expression array
Tangerine™ expression profiling
Gene expression analysis on biopsy samples
Profiling gene expression patterns of white blood cells
Serial analysis of gene expression (SAGE)
Multiplexed Molecular Profiling
Gene expression analysis using competitive PCR and MALDI TOF MS
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Molecular imaging and personalized medicine
Combination of diagnostics and therapeutics
Use of molecular diagnostics for stratification in clinical trials
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Companies developing point-of-care diagnostic technologies
Point-of-care diagnosis of infections
Advantages versus disadvantages of point-of-care diagnosis
Future prospects of point-of-care diagnosis
Genetic testing for disease predisposition
Preventive genetics by early diagnosis of mitochondrial diseases
Direct-to-consumer genetic services
Role of diagnostics in integrated healthcare
Concept of integrated healthcare
Components of integrated healthcare
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Causes of variations in drug metabolism
Enzymes relevant to drug metabolism
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P450 CYP 2D6 inhibition by selective serotonin reuptake inhibitors
Cytochrome P450 polymorphisms and response to clopidogrel
Lansoprazole and cytochrome P450
Glucose-6-phosphate dehydrogenase
Pharmacogenetics of phase II metabolism
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Uridine diphosphate-glucuronosyltransferase
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Polymorphism of drug transporters
Genetic variation in drug targets
Polymorphisms of kinase genes
Effect of genetic polymorphisms on disease response to drugs
Ethnic differences in drug metabolism
Gender differences in pharmacogenetics
Role of pharmacogenetics in drug safety
Adverse drug reactions
Adverse drug reactions in children
Adverse drug reactions related to toxicity of chemotherapy
Genetically determined adverse drug reactions
Malignant hyperthermia
Pharmacogenetics of clozapine-induced agranulocytosis
Role of pharmacogenetics in warfarin therapy
Role of pharmacogenetics in antiplatelet therapy
Role of pharmacogenetics in carbamazepine therapy
Role of pharmacogenetics in statin therapy
FDA consortium linking genetic biomarkers to serious adverse events
Therapeutic drug monitoring, phenotyping, and genotyping
Therapeutic drug monitoring
Phenotyping
Genotyping
Genotyping vs phenotyping
Phenomics
Limitations of genotype-phenotype association studies
Molecular toxicology in relation to personalized medicines
Toxicogenomics
Biomarkers of drug toxicity
Drug-induced mitochondrial toxicity
Companies involved in molecular toxicology
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Pharmacogenetics in clinical trials
Postmarketing pharmacogenetics
Clinical implications of pharmacogenetics
Application of CYP450 genotyping in clinical practice
Pharmacogenomic biomarker information in drug labels
Genotype-based drug dose adjustment
Use of pharmacogenetics in clinical pharmacology
Application of CYP2C19 pharmacogenetics for personalized medicine
Genotyping for identifying responders to sulfasalazine
HLA alleles associated with lumiracoxib-related liver injury
Pharmacogenetic basis of thiopurine toxicity
Tranilast-induced hyperbilirubinemia due to gene polymorphism
Linking pharmacogenetics with pharmacovigilance
Genetic susceptibility to ADRs
Linking genetic testing to postmarketing ADR surveillance
Recommendations for the clinical use of pharmacogenetics
Limitations of pharmacogenetics
Pharmacoeopigenomics vs pharmacogenetics in drug safety
Future role of pharmacogenetics in personalized medicine

4. Pharmacogenomics
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Pharmacogenomics and drug discovery
Preclinical prediction of drug efficacy
Pharmacogenomics and clinical trials
Impact of genetic profiling on clinical studies
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Pharmacogenomics of depression
Pharmacogenomics of schizophrenia
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Diseases due to misfolding of proteins
Therapies for protein misfolding
Significance of mitochondrial proteome in human disease
Proteomic technologies for drug discovery and development
Proteins and drug action
Role of reverse-phase protein microarray in drug discovery
Role of proteomics in clinical drug safety
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Applications of pharmacoproteomics in personalized medicine

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Lipid profiling
Role of metabolomics in biomarker identification and pattern recognition
Validation of biomarkers in large-scale human metabolomics studies
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Metabonomic technologies for toxicology studies
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Cloning and personalized cell therapy
Use of stem cells for drug testing
Gene therapy
Gene editing by CRISPR/Cas9 system
Stem cell-based personalized gene therapy for cancer
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8. Personalized Non-pharmacological Therapies
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CD4 counts as a guide to drug therapy for AIDS
Drug-resistance in HIV
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Personalized vaccine for HIV
Prevention of adverse reactions to antiviral drugs
Pharmacogenetics and HIV drug safety
Pharmacogenomics of antiretroviral agents
Role of diagnostic testing in management of HIV
Role of genetic variations in susceptibility to HIV-1
Role of personalized HIV therapy in controlling drug resistance
PhenoSense® to test HIV drug resistance
Sequencing for detecting mutations to personalize HIV therapy
Personalized treatment of hepatitis B
Personalized treatment of hepatitis C
Responders vs non-responders to treatment for hepatitis C
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Personalized management of fungal infections
Psychiatric disorders
Psychopharmacogenetics/psychopharmacodynamics
Serotonin genes
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Dopamine receptor genes
COMT genotype and response to amphetamine
Methylenetetrahydrofolate reductase
Genotype and response to methylphenidate in children with ADHD
GeneSight tests for individualized therapy of psychiatric disorders
Personalized antipsychotic therapy
Personalized antidepressant therapy
Biomarkers of response to antidepressant treatment
EEG to predict adverse effects and evaluate antidepressant efficacy
Individualization of SSRI treatment
Role of protein sFRP3 in predicting response to antidepressants
Treatment resistant depression
Vilazodone with a test for personalized treatment of depression
Neurological disorders
Introduction to personalized neurology
Personalized management of Alzheimer's disease
Personalized management of Parkinson's disease
Direct-to-consumer genetic testing in PD
Discovery of subgroup-selective drug targets in PD
Personalized cell therapy for PD
Personalized management of epilepsy
Biomarkers of epilepsy
Genetics/genomics of epilepsy
Choice of the right AED
Adverse effects of AEDs
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An algorithm for personalized management of epilepsy
Future prospects for management of epilepsy
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Individualization of use of triptans for migraine
Multtarget therapeutics for personalized treatment of headache
Personalized management of intracranial aneurysms
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Anticoagulation for stroke prevention
Application of proteomics for personalizing stroke management
Brain imaging in trials of restorative therapies for stroke
Decisions for evacuation of intracerebral hemorrhage
Revascularization procedures in chronic post-stroke stage
Personalized cell therapy for management of stroke
Management of stroke according to stage
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Immunopathological patterns of demyelination for assessing therapy
Personalizing mitoxantrone therapy of multiple sclerosis
Autologous bone marrow stem cell therapy for multiple sclerosis
Fusokine method of personalized cell therapy of multiple sclerosis
Pharmacogenomics of IFN-ß therapy in multiple sclerosis
T cell-based personalized vaccine for MS
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Genetic mutations with loss of pain
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Personalized management of pain with opioids
Pharmacogenetics of NSAIDs
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Preoperative testing to tailor postoperative analgesic requirements
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Signature of pain on brain imaging
Concluding remarks on personalized management of pain
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Personalized management of ophthalmic disorders
Proteomics-based personalized management of uveitis
Combining cell and gene therapies for retinal disorders
Cardiovascular disorders
Role of diagnostics in personalized management of cardiovascular disease
Cardiovascular disorders with a genetic component
Gene mutations associated with risk of coronary heart disease
Gene variant as a risk factor for sudden cardiac death
KIF6 gene test as a guide to management of heart disease
NGS sequencing for management of cardiovascular disorders
Testing in coronary heart disease
Biomarkers and personalized management of cardiovascular disorders
Pharmacogenomics of cardiovascular disorders
Modifying the genetic risk for myocardial infarction
Companion diagnostics for therapy of cardiovascular disorders
Personalized management of chronic myocardial ischemia
Management of chronic angina pectoris
Management of heart failure
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BiDil
Management of atrial fibrillation
Management of hypertension
Adjusting therapy of hypertension to fluctuations of blood pressure
Choice of drugs for hypertension
Control of blood pressure with vagal nerve stimulation
Correction of causes and risk factors of hypertension
Genes and hypertension
Improving management of HPN by targeting new pathways
Individualized therapy of HPN based on risk factors of heart disease
Personalized management of hypertensive patients with albuminuria
Personalized management of hypertension in the elderly
Personalized management of hypertension in women
Pharmacogenomics of diuretic drugs
Pharmacogenomics of ACE inhibitors
Prediction of antihypertensive activity of rostafuroxin
Role of pharmacogenetics in management of hypertension
Scheme for management of hypertension by personalized approach
Personalized lipid-lowering therapies
NIR spectroscopy of plaques to guide cholesterol-lowering therapy
Polymorphisms in genes involved in cholesterol metabolism
Role of eNOS gene polymorphisms
Prediction of response to statins
Personalized management of women with hyperlipidemia
Therapeutic alternatives in patients with statin intolerance
Treatment of familial hypercholesterolemia
PCSK9 inhibitors
Thrombotic disorders
Factor V Leiden mutation
Anticoagulant therapy
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Personalized management of aortic aneurysms
Nanotechnology-based personalized therapy of cardiovascular diseases
Project euHeart for personalized management of heart disease
Concluding remarks on personalized management of cardiovascular diseases
Personalized management of pulmonary disorders
Role of genetic ancestry in lung function
Targeted drug delivery for personalized management of pulmonary disorders
Personalized therapy of asthma
Asthma phenotyping for improving therapeutic precision
Biomarkers for predicting response to corticosteroid therapy
Genetic polymorphism and response to β-adrenergic agonists
Genotyping in asthma
IgE as guide to dosing of omalizumab for asthma
Lebrikizumab for personalised treatment of asthma
Personalized management of chronic obstructive pulmonary disease
Personalized management of skin disorders
Genetic testing for personalized skin care
Management of hair loss based on genetic testing
Personalized approaches in immunology
Immunological tests in personalized medicine
Antibody profiles
Role of Mannose-binding lectin testing in personalized medicine
Pharmacogenetics and pharmacogenomics of immunosuppressive agents
Personalized management of patients with lupus erythematosus
Personalized therapy of rheumatoid arthritis
Genetics and epigenetic aspects of rheumatoid arthritis
Variations in the effectiveness of therapies for RA
Biomarkers for personalizing therapy of rheumatoid arthritis
DIATSTAT™ anti-cyclic citrullinated peptides in rheumatoid arthritis
Personalization of COX-2 inhibitor therapy
Personalization of infliximab therapy
Personalized therapy of RA guided by anti-citrullinated protein antibodies
Personalized management of obesity
Basics of obesity
Genetics of obesity as a basis for personalized management
Personalized management of diabetes
Management of genetic disorders
Personalized treatment of cystic fibrosis
Personalized management of gastrointestinal disorders
Role of microbiome in personalized management of gastrointestinal disorders
Personalized therapy of inflammatory bowel disease
Personalized management of lactose intolerance
Personalized approaches to improve organ transplantation
Personalization of kidney transplantation
Cell-based bioengineered kidney transplant
Personalization of cardiac transplantation
Cell-based regeneration of heart for personalized transplantation
Prediction of rejection for personalizing anti-rejection treatment
Personalized immunosuppressant therapy in organ transplants
Role of immunological biomarkers in monitoring grafted patients
Improved matching of blood transfusion
Personalized approaches to addiction
Reversal of cocaine-evoked synaptic plasticity
Pharmacogenetics of drug addiction
Genetic polymorphism and management of alcoholism
Personalized therapy for smoking cessation
Antidepressant therapy for smoking cessation
Effectiveness of nicotine patches in relation to genotype
Personalized geriatrics
Chronological vs biological age
Pharmacogenetics and adverse drug reactions
Personalized pediatrics
WGS for personalized management of genetic disorders in critically ill infants
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Female sexual dysfunction
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Gene associated with end-stage renal disease
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10. Personalized Therapy of Cancer
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Cell division and mitotic spindles
DNA damage, repair and cancer
Chromosomes and cancer
Chromosomal instability
Telomeres and cancer
Gene mutations and cancer
Systems biology of cancer
Relationships of technologies for personalized management of cancer
Impact of molecular diagnostics on the management of cancer
A universal NGS-based oncology test system
Analysis of RNA splicing events in cancer
Analysis of chromosomal alterations in cancer cells
Cancer classification using microarrays
Catalog of cancer genes for personalized therapy
Detection of loss of heterozygosity
Diagnostics for detection of minimal residual disease
DNA repair biomarkers
Fluorescent in situ hybridization
Gene expression profiling
Gene expression profiles predict chromosomal instability in tumors
OnkoMatch tumor genotyping
Synthetic dosage lethality predicts tumor growth and patient survival
Isolation and characterization of circulating tumor cells
Modulation of CYP450 activity for cancer therapy
NanoFlares for detection of CTCs
Pathway-based analysis of cancer
Conversion of gene-level information into pathway-level information
Personalized therapies based on oncogenic pathways signatures
Quantum dot-based test for DNA methylation
Role of molecular imaging in personalized therapy of cancer
Functional diffusion MRI
FDG-PET/CT for personalizing cancer treatment
Image-guided personalized drug delivery in cancer
Optoacoustic imaging and nanoparticles in cancer management
Tumor imaging and elimination by targeted gallium corrole
Future prospects of molecular imaging in management of cancer
Unraveling the genetic code of cancer
Cancer prognosis
Detection of mutations for risk assessment and prevention
Impact of biomarkers on management of cancer
HER-2/neu oncogene as a biomarker for cancer
L-asparaginase treatment of cancer guided by a biomarker
Oncogene GOLPH3 as a cancer biomarker
Predictive biomarkers for cancer
Sequencing to discover biomarkers to personalize cancer treatment
VeraTag™ assay system for cancer biomarkers
Determination of response to therapy
Biomarker-based assays for predicting response to anticancer therapeutics
Ex vivo testing of tumor biopsy for chemotherapy sensitivity
Gene expression patterns to predict response of cancer to therapy
Genomic analysis of tumor biopsies
Genotype-dependent efficacy of pathway inhibition in cancer
Mutation detection at molecular level
RNA Disruption Assay™
Role of genetic variations in susceptibility to anticancer drugs
Non-genetic factors for variations in response of cancer cells to drugs
Proteomic analysis of tumor biopsies to predict response to treatment
Real-time apoptosis monitoring
Serum nucleosomes as indicators of sensitivity to chemotherapy
Targeted microbubbles to tumors for monitoring anticancer therapy
PET imaging for determining response to chemotherapy
PET imaging with tyrosine kinase inhibitors
Concluding remarks about predicting response to anticancer therapy
Molecular diagnostics combined with cancer therapeutics
Aptamers for combined diagnosis and therapeutics of cancer
Combining diagnosis and therapy of metastatic cancer
Detection and destruction of CTCs with nanoparticles and X-rays
Molecular profiling of cancer
Targeted cancer therapies
Targeting glycoproteins on cell surface
Targeting pathways in cancer
Targeted personalized anticancer medicines in clinical use
Immunotherapy of cancer
Monoclonal antibodies for personalized management of cancer
Targeted MAb-based immune therapy of cancer
MAbs targeted to alpha fetaprotein receptor
MAbs targeted to tumor blood vessels
MAbs that selectively target cancer
Velociximab
MAbs for immune activation
Functional MAb-based therapies
Immunotherapy of dormant cancer
Combined use of MAbs and cytokines
Combining diagnostics with therapeutics based on MAbs
Radiolabeled antibodies for detection and targeted therapy of cancer
Cancer immunotherapy based on suppression of enzymes
Personalized cancer vaccines
Antigen-specific vaccines
Active immunotherapy based on antigen specific to the tumor
Tumor-derived vaccines
FANG vaccine
MyVax
OncoVAX
Tumor cells treated with dinitrophenyl
Prophage
Melacine
Patient-specific cell-based vaccines
Dendritic cell-based vaccines
Adoptive cell therapy
Combination of antiangiogenic agents with ACT
Genetically targeted T cells for treating B cell malignancies
Genetic engineering of tumor cells
Hybrid cell vaccination
Personalized peptide cancer vaccines
Targeting core mutations in cancer
Current status and future prospects of personalized cancer vaccines
Personalized radiation therapy
Peptide receptor radionuclide therapy
Use of radiation sensitivity biomarkers to personalized radiotherapy
Use of imaging to monitor radioimmunotherapy of non-Hodgkin lymphoma
Role of nanobiotechnology in personalized management of cancer
Design of future personalized cancer therapies
Personalized therapy of cancer based on cancer stem cells
Role of CRISPR-Cas9 in personalized cancer gene therapy
Role of epigenetics in development of personalized cancer therapies
Cancer epigenetics and immunotherapy
Selective destruction of cancer cells while sparing normal cells
Sphingolipids
Hyperbaric oxygen as adjunct to radiotherapy
Targeting response to transformation-induced oxidative stress
Targeting enzymes to prevent proliferation of cancer cells
Tissue systems biology approach to personalized management of cancer
Role of oncoproteomics in personalized therapy of cancer
Cancer tissue proteomics
Proteomics technologies to guide targeted drug selection for cancer
LC-MS/MS proteomics as a companion diagnostic
Personalized cancer therapy based on targeted proteomics
Role of sequencing in personalized therapy of cancer
Pharmacogenomic-based chemotherapy
Whole genome technology to predict drug resistance
Anticancer drug selection based on molecular characteristics of tumor
Testing microsatellite-instability for response to chemotherapy
Pharmacogenetics of cancer chemotherapy
CYP 1A2
Thiopurine methyltransferase
Dihydropyrimidine dehydrogenase
UGT1A1 test as guide to irinotecan therapy
Role of computational models in personalized anticancer therapy
A computational model of kinetically tailored treatment
Mathematical modeling of tumor microenvironments
Modeling signaling pathways to reposition anticancer drugs
Therapy resistance in cancer
Mechanism of therapy resistance in cancer
Cancer stem cells and radioresistance
Expression of P-glycoprotein gene by tumor
Overexpression of multidrug resistance gene
P53 mutations
Role of splice variants in resistance to cancer therapy
Detection of drug resistance
Anaplastic lymphoma kinase
Metabolic profiling of cancer
Management of drug resistance in cancer
Chemogenomic approach to drug resistance
Determination of chemotherapy response by topoisomerase levels
Management of drug resistance in leukemia
Patient-derived xenograft mouse models in drug resistant cancer
Resistance to vaccines in cancer recurrence after surgery
Systems biology approach to drug-resistant cancer
Personalized therapy of cancer metastases
Technologies for analysis of CTCs
Microfluidic technologies
BEAMing technology for analysis of circulating tumor DNA
Technologies for detection of interplay of environments and CTCs
Systemic antitumor effect of localized radiotherapy for cancer metastases
Diagnosis of cancer of an unknown primary
Personalized management of cancers of various organs
Personalized management of brain tumors
Aptamers for selective targeting of tumor initiating cells in GBM
Bioinformatic approach to personalizing treatment of GBM
Biosimulation approach to personalizing treatment of brain cancer
Companion diagnostic for viral gene therapy of brain cancer
Drug resistance in GBM
Genetics and genomics of brain cancer
MALDI-MS image-guided surgery of pituitary adenomas
Molecular diagnostics for personalized management of brain cancer
Glioma Actively Personalized Vaccine Consortium
Personalized chemotherapy of brain tumors
Personalized therapy of oligodendrogial tumors
Personalized therapy of neuroblastomas
Personalized therapy of medulloblastomas
Personalized management of germ cell brain tumors
Personalized management of meningiomas
Supratentorial hemispheric diffuse low-grade gliomas
Targeted therapy of BRAF V600E mutant papillary craniopharyngioma
Future prospects of personalized therapy of malignant brain tumors
Personalized management of breast cancer
Developing personalized drugs for breast cancer
Gene expression plus conventional predictors of breast cancer
Her2 testing in breast cancer as a guide to treatment
HER2/neu-derived peptide vaccine for breast cancer
Trends in treatment patterns and outcomes for DCIS
Molecular diagnostics in breast cancer
Molecular classification of infiltrating breast cancer
Monitoring of circulating tumor cells in breast cancer
Pharmacogenetics of breast cancer
Proteomics-based personalized management of breast cancer
Predicting response to chemotherapy in breast cancer
Prediction of resistance to chemotherapy in breast cancer
Prediction of adverse reaction to radiotherapy in breast cancer
Prediction of recurrence in breast cancer for personalizing therapy
Prognostic tests for breast cancer
Racial factors in the management of breast cancer
RATHER consortium to study personalized approach to breast cancer
TAILORx (Trial Assigning Individualized Options for Treatment)
Tamoxin therapy for ER-positive breast cancer
Triple negative breast cancer
Trends and future prospects of breast cancer research
Understanding tumor diversity in mouse mammary cancer model
Personalized management of ovarian cancer
Early diagnosis of ovarian cancer
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