

vival, *Clin. Cancer Res.*, 10:3042-3052; Shakhman et al., 2003, *Induction by {beta}-bungarotoxin of apoptosis in cultured hippocampal neurons is mediated by Ca²⁺-dependent formation of reactive oxygen species*, *J. Neurochem.*, 87:598-608; Shibata et al., 2004, *Lovastatin inhibits tumor growth and lung metastasis in mouse mammary carcinoma model: a p53-independent mitochondrial-mediated apoptotic mechanism*, *Carcinogenesis*, 25:1887-98; Smith et al., 2003, *LFA-1-induced T cell migration on ICAM-1 involves regulation of MLCK-mediated attachment and ROCK-dependent detachment*, *J. Cell Sci.*, 116:3123-3133; Smolewska et al., 2003, *Apoptosis of peripheral blood lymphocytes in patients with juvenile idiopathic arthritis*, *Ann. Rheum. Dis.*, 62:761-763; Smolewski et al., 2003, *Caspase-mediated cell death in hematological malignancies: theoretical considerations, methods of assessment, and clinical implications*, *Leuk Lymphoma*, 44:1089-104; Strasberg Rieber et al. 2004, *Tumor apoptosis induced by ruthenium(II)-ketoconazole is enhanced in nonsusceptible carcinoma by monoclonal antibody to EGF receptor*, *Int J Cancer*, 112:376-84; Strife et al., 2003, *Direct Evidence That Bcr-Abl Tyrosine Kinase Activity Disrupts Normal Synergistic Interactions Between Kit Ligand and Cytokines in Primary Primitive Progenitor Cells*, *Mol. Cancer Res.*, 1:176-185; Szodoray et al., 2003, *Programmed cell death in rheumatoid arthritis peripheral blood T-cell subpopulations determined by laser scanning cytometry*, *Lab Invest.*, 83:1839-48; Takemoto et al., 2004, *Cell Cycle-dependent Phosphorylation, Nuclear Localization, and Activation of Human Condensin*, *J. Biol. Chem.*, 279:4551-4559; Takita et al., 2003, *An analysis of changes in the expression of cyclins A and B1 by the cell array system during the cell cycle: Comparison between cell synchronization methods*, *Cytometry*, 55A:24-9; Tamamori-Adachi et al., 2003, *Critical Role of Cyclin D1 Nuclear Import in Cardiomyocyte Proliferation*, *Circ. Res.*, 92:12e-19; Tamamori-Adachi et al., 2004, *Down-regulation of p27Kip1 promotes cell proliferation of rat neonatal cardiomyocytes induced by nuclear expression of cyclin D1 and CDK4. Evidence for impaired Skp2-dependent degradation of p27 in terminal differentiation*, *J. Biol. Chem.*, 279:50429-36; Valet et al., 2004, *Cytomics—new technologies: towards a human cytochrome project*, *Cytometry*, 59A:167-71; Vieyra et al., 2003, *Altered Subcellular Localization and Low Frequency of Mutations of ING1 in Human Brain Tumors*, *Clin. Cancer Res.*, 9:5952-5961; Villamarin et al., 2003, *A comparative analysis of the time-dependent antiproliferative effects of daunorubicin and WP631*, *Eur. J. Biochem.*, 270:764-770; Walker et al., 2003, *Phenotype versus Genotype in Gliomas Displaying Inter- or Intratumoral Histological Heterogeneity*, *Clin. Cancer Res.*, 9:4841-4851; Wang et al., 2003, *Loss of 13q14-q21 and Gain of 5p14-pter in the Progression of Leiomyosarcoma*, *Mod. Pathol.*, 16:778-785; Wang et al., 2003, *Genomic instability and endoreduplication triggered by RAD17 deletion*, *Genes & Dev.*, 17:965-970; Williams et al., 2003, *Differential effects of the proteasome inhibitor bortezomib on apoptosis and angiogenesis in human prostate tumor xenografts*, *Mol. Cancer Ther.*, 2:835-843; Wu et al., 2003, *Telomere dysfunction: a potential cancer predisposition factor*, *J Natl Cancer Inst.*, 95:1211-8; Yellon et al., 2003, *The role of leukocyte traffic and activation in parturition*, *J Soc Gynecol Investig.*, 10:323-38; Yuan et al., 2004, *The duration of nuclear extracellular signal-regulated kinase 1 and 2 signaling during cell cycle reentry distinguishes proliferation from apoptosis in response to asbestos*, *Cancer Res.*, 64:6530-6, Zabaglo et al., 2003, *Mea-*

surement of proliferation marker Ki67 in breast tumour FNAs using laser scanning cytometry in comparison to conventional immunocytochemistry, *Cytometry*, 56B:55-61; Zabaglo et al., 2003, *Cell filtration-laser scanning cytometry for the characterisation of circulating breast cancer cells*, *Cytometry*, 55A:102-108; Zhang et al., 2004, *From The Cover: High urea and NaCl carbonylate proteins in renal cells in culture and in vivo, and high urea causes 8-oxoguanine lesions in their DNA*, *PNAS*, 101:9491-9496; Zheng et al., 2004, *Calphostin-C induction of Vascular Smooth Muscle Cell Apoptosis Proceeds through Phospholipase D and Microtubule Inhibition*, *J. Biol. Chem.*, 279:7112-18.

[0174] Many other assay methods are known or can be developed. Reagents appropriate for each reaction type will be provided in the sample and/or prepositioned in the reaction chamber. Exemplary reagents include antibodies, ligands, enzyme substrates, effectors and the like.

Exemplary Applications

[0175] The following prophetic examples are intended to illustrate aspects of the invention. However, these examples are for illustration only and are not intended to limit the invention in any fashion.

[0176] 1. Detection and Characterization of Pathogens

[0177] The methods of the invention may be used for detection, identification and characterization of pathogens. There are many situations in which a sample contains a heterogeneous mixture of microorganisms (e.g., various bacterial species or strains, viruses, fungi) for which rapid detection and identification would be advantageous. For example, clinical (patient) samples often contain small numbers of microorganisms (e.g., bacteria, fungi) or viruses. Rapid characterization would permit earlier administration of appropriate drugs, if necessary. Similarly, the ability to rapidly detect and identify cellular and viral pathogens would be of value in the medical, veterinary, and agricultural fields, as well as in response to actual or suspected bioterrorism and for rapid detection water or food contaminants. In many cases a relatively small number of cells are available to work with, and, as noted, the cells are often available as a heterogeneous mixture with other cells.

[0178] In one illustrative embodiment, the method is used to determine whether a patient is infected with methicillin-resistance *S. aureus*. *S. aureus* can be identified using a bacteria-specific probe (e.g. to a rRNA gene). An methicillin resistant strain is distinguished from non-resistant strains based on a characteristic genetic sequence such as an open reading frame (gene or gene segment) or single polynucleotide polymorphism. A sample containing bacteria cells is obtained from a patient (e.g., a nose swab containing about 100 bacterial cells) and diluted into a reaction mixture containing nucleic acid primers and other reagents for amplification and detection of target sequences (e.g., PCR reagents, molecular beacons, polymerase, nucleotides, agents that lyse cells for nucleic acid release, etc.). Exemplary PCR primers are described in Huletsky et al., 2004, "New real-time PCR assay for rapid detection of methicillin-resistant *Staphylococcus aureus* directly from specimens containing a mixture of staphylococci." *J Clin Microbiol.* 42:1875-84. One primer/probe set in the reaction mixture emits a red fluorescence signal in the presence of a *S. aureus* target sequence found in both resistant and non-resistant stains while the second primer/probe set emits a green fluorescence signal only in the presence of a *S. aureus* target sequence found in the resistant