GeneXpert Patent Landscape[1]

GeneXpert cartridges[2]

Relevant Patents/Applications –

Patent/Application No.	Title	Assignee	Filing Date	Priority Date	Broadest Claim	Government Rights
US 6,374,684	Fluid Control and Processing System	Cepheid	08/25/00	08/25/00	1. A fluid control and processing system comprising: a housing having a plurality of chambers; and a valve body including a fluid sample processing region continuously coupled fluidicly with a fluid displacement region, the fluid displacement region being depressurizable to draw fluid into the fluid displacement region and pressurizable to expel fluid from the fluid displacement region, the valve body including a plurality of external ports, the fluid sample processing region including a plurality of fluid processing ports each fluidicly coupled with one of the external ports, the fluid displacement region being fluidicly coupled with at least one of the external ports, and the valve body being adjustable with respect to the housing to allow the external ports to be placed selectively in fluidic communication with the plurality of chambers.	None found.
US 6,818,185 Child: • 10/955,811 (patented, issued as US 8,168,442); • 13/436,475 (patented; issued as US 8,709,363); • 14/218,517	Cartridge for Conducting a Chemical Reaction	Cepheid	05/30/00	05/28/99	1. A device for conducting a chemical reaction, the device comprising: a) a body having at least first and second channels formed therein; and b) a reaction vessel extending from the body, the reaction vessel having: i) a rigid frame defining side walls of a reaction chamber; ii) first and second polymeric films attached to opposite sides of the rigid frame to form opposing major walls of the reaction chamber; iii) an inlet port connected to the reaction chamber via an inlet channel; and iv) an outlet port connected to the reaction chamber via an outlet	None found.

[1] An external law firm was commissioned by Public Citizen to conduct this analysis in 2014.

[2] According to http://investorshub.advfn.com/boards/read_msg.aspx?message_id=340249.

(pending)					channel; wherein the inlet port of the vessel is connected to the first channel in the body and wherein the outlet port of the vessel is connected to the second channel in the body.	

Real-Time Thermal Cycler – (licensed under the following patents)[3]

Relevant Patents/Applications –

Patent/Application No.	Title	Assignee	Filing Date	Priority Date	Broadest Claim	Government Rights
US 6,814,934 Parent: • Division of 07/695,201 (patented, issued as US 5,994,056) Child: • 09/717,946 (abandoned); • 09/717,707 (abandoned)	Instrument for Monitoring Nucleic Acid Amplification	Applied Biosystems, Inc.	11/12/97	05/02/91	1. An instrument for use in monitoring a nucleic acid amplification reaction comprising multiple thermal cycles, comprising: (a) an automated thermal cycler capable of alternately heating and cooling, and adapted to receive, at least one reaction vessel containing an amplification reaction mixture comprising a target nucleic acid, reagents for nucleic acid amplification, and a detectable nucleic acid binding agent; and (b) a detector operable to detect a fluorescence optical signal while the amplification reaction is in progress and without opening the at least one reaction vessel, which fluorescence optical signal is related to the amount of amplified nucleic acid in the reaction vessel.	None found.
US 5,589,136 Child: • 08/763,465 (patented, issued as US 6,524,532); • 09/545,440 (patented, issued as US 6,602,473); • 08/774,170 (patented, issued as US 6,521,181)	Silicon-Based Sleeve Devices for Chemical Reactions	Regents of the University of California	06/20/95	06/20/95	1. In a microfabricated chemical reactor having a reaction chamber, the improvement comprising: a sleeve reaction chamber, said sleeve reaction chamber having a slot therein, said slot being constructed to enable insertion of an insert or liner therein, and heating means for said sleeve reaction chamber.	The United States Government has rights in this invention pursuant to Contract No. W-7405-ENG-48 between the United States Department of Energy and the University of California for the operation of Lawrence

[3] According to the GeneXpert DX System Product Insert, *available at* http://infomine.cepheideurope.com/automne_modules_files/ged/public/r2785_25_infomineomom_gx_2.1300-5990_gx_dx_operator_manual_english_rev_a.1_2.1.pdf)

						Livermore National Laboratory.
US 6,787,338 (Expired Due to Nonpayment of Maintenance Fees) Parent: • Continuation of 08/537,612 (abandoned); • CIP of 08/179,969 (patented, issued as US 5,455,175); • CIP of 07/815,966 (abandoned); • CIP of 07/534,029 (abandoned) Child: • 10/843,075 (abandoned); • 10/891,161 (patented, issued as US 7,238,321)	Method for Rapid Thermal Cycling of Biological Samples	The University of Utah	08/11/98	06/04/90	1. A method of subjecting a sample to rapid thermal cycling, said method comprising: a) contacting a sample holder containing a sample with heated fluid, thereby raising the temperature of the sample to a first temperature, and holding the sample at about said first temperature for a first predetermined period of time; b) contacting the sample holder with non-heated fluid, thereby lowering the temperature of the sample to a second temperature, an holding the sample at about said second temperature for a second predetermined period of time; c) contacting the sample holder with heated fluid, thereby raising the temperature of the sample to a third temperature, and holding the sample at about said third temperature for a third predetermined period of time; wherein steps a) through c) are completed within a time range of about 30 seconds to 60 seconds and repeated at least one time; and wherein said sample holder has a thermal mass which provides for completing said cycle within said time range.	None found.
US 6,503,720 Parent: • Continuation of 09/281,448 (patented, issued as US 6,303,305)	Method for Quantification of an Analyte	Roche Diagnostics GMBH, University of Utah Research Foundation	02/20/01	03/30/99	1. A method for quantification of the concentration of a nucleic acid in a nucleic acid sample, comprising the steps of: a) contacting said nucleic acid sample with an amplifying agent; b) amplifying at least one predetermined locus of the nucleic acid in said nucleic acid sample by a process comprising the step of subjecting the sample to a number of amplification cycles to create a nucleic acid amplification product;	None found.

					c) determining a value proportional to the amount of the nucleic acid amplification product present at each amplification cycle and using the values to generate a function; d) calculating the first, second or n th order derivative of said function, wherein n is a positive integer; e) determining a fractional cycle number corresponding to a maximum or minimum of said derivative; and f) calculating from said maximum or minimum an initial concentration of the nucleic acid in said nucleic acid sample.	
US 6,174,670 Parent: • Continuation of 08/818,267 (abandoned); • CIP of 08/658,993 (abandoned) Child: • 09/398,629 (patented, issued as US 6,245,514); • 09/635,344 (patented, issued as US 6,232,079); • 09/799,160 (patented, issued as US 6,569,627); • 10/397,759 (patented, issued as US 7,160,998); • 11/203,947 (patented, issued as US	Monitoring Amplification of DNA During PCR	University of Utah Research Foundation	06/04/97	06/04/96	1. A method for analyzing a target DNA sequence of a biological sample, said method comprising the steps of amplifying the target sequence by polymerase chain reaction in the presence of two nucleic acid probes that hybridize to adjacent regions of the target sequence, one of said probes being labeled with an acceptor fluorophore and the other probe labeled with a donor fluorophore of a fluorescence energy transfer pair such that upon hybridization of the two probes with the target sequence, the donor and acceptor fluorophores are within 25 nucleotides of one another, said polymerase chain reaction comprising the steps of adding a thermostable polymerase and primers for the targeted nucleic acid sequence to the biological sample and thermally cycling the biological sample between at least a denaturation temperature and an elongation temperature; exciting the biological sample with light at a wavelength absorbed by the donor fluorophore and detecting fluorescent emission from the fluorescence energy transfer pair.	None found.

7,670,832); • 11/926,775 (pending); • 11/931,178 (abandoned); • 13/465,364 (patented, issued as US 8,343,754); • 90/012,369 (pending)						

C. difficile[4]

Relevant Patents/Applications –

Patent/Application No.	Title	Assignee	Filing Date	Priority Date	Broadest Claim	Government Rights
US 5,582,989 Parent: • Continuation of 08/060,463 (abandoned); • Continuation of 07/770,742 (abandoned); • Continuation of 07/256,689 (abandoned) Child: • 90/010,062 (reexam); • 90/009,495 (reexam); • 90/011,123 (reexam)	Multiplex Genomic DNA Amplification for Deletion Detection	Baylor College of Medicine	09/30/94	10/12/88	1. A method for simultaneously detecting known deletions from at least three DNA sequences, comprising the steps of: treating said DNA to form single-stranded complementary strands; adding at least three pairs of oligonucleotide primers, each pair specific for a different sequence, one primer of each pair substantially complementary to a part of the sequence in the sense-strand and the other primer of each pair substantially complementary to a different part of the same sequence in the complementary anti-sense strand; annealing the at least three pairs of primers to their complementary sequences, all primers being subjected to the same reaction conditions; simultaneously extending said at least three pairs of annealed primers from each primer's 3' terminus to synthesize an extension product complementary to the strands annealed to each primer, said extension products, after separation from their complement, being capable of serving as templates for the synthesis of an extension product from the other primer of each pair; separating said extension products from said templates to produce single-stranded molecules; amplifying said single stranded molecules by repeating, at least once, said annealing, extending and separating steps; and identifying said amplified extension products from each different sequence.	None found.
US 5,851,767	Detection of	The Regents of	06/06/95	03/04/85	1. A method for detecting the presence of mycoplasma specific	This invention

[4] According to Xpert *C. difficile* Package Insert, *available at* http://www.diagnostictechnology.com.au/persistent/catalogue_files/products/xpertcdifficilepi.pdf.

Parent: • Continuation of 08/136,723 (abandoned); • Continuation of 08/020,874 (abandoned); • Continuation of 07/799,856 (abandoned); • Continuation of 07/191,852 (abandoned); • Continuation of 06/707,725 (abandoned) Child: • 09/152,375 (patented, issued as US 6,245,509)	Prokaryotic Organism by DNA Hybridization	the University of California			nucleic acids, which comprises: contacting a medium, which may contain a nucleic acid or nucleic acid fragment from said mycoplasma having said particular nucleotide sequence, with an oligonucleotide, said oligonucleotide comprising a nucleotide sequence complementary to said particular nucleotide sequence, whereby said oligonucleotide hybridizes with any nucleic acid or nucleic acid fragment from said mycoplasma which may be present in said medium; and detecting the presence of any nucleic acid or nucleic acid fragment hybridized with said oligonucleotide; wherein said particular nucleotide sequence includes at least one of the following mycoplasma-specific sequence regions or a sequence region, of at least nine nucleotides, complementary to at least one of the following sequences: 5'AACACGTATC3', 5'CGAATCAGCTATGTCG3', 5'GAGGTT-AAC3', 5'ATCCGGATTTATT3', 5'TCTCAGTTCGGATTGA3', 5'AGGTGGTGCATGGTTG3', 5'TCCTGGCTCAGGAT3', 5'ATACATAGGT3', 5'AACTATGTGC3', 5'AATTTTTCACAATG3', 5'TCTCGGGTCT3', and 5'TAGATATATG3', wherein T represents thymine, G represents guanine, A represents adenine, C represents cytosine and - indicates a nucleotide deletion within the sequence; wherein said oligonucleotide hybridizes with the nucleic acid or nucleic acid fragment from mycoplasma but not nucleic acids from eukaryotic or from other prokaryotic organisms, and wherein said oligonucleotide comprises at least nine nucleotides but is less than the length of mycoplasma rRNA or the nucleic acid sequence encoding mycoplasma rRNA.	was made with Government support under Grant No. AI/AM 14096-01 with the National Institutes of Health and the University of California. The Government has certain rights in this invention.

SKGF Term Search #1: "automated" "diagnostic" "cartridge" "integrated" "PCR"

Relevant Patents/Applications –

Patent/Application No.	Title	Assignee	Filing Date	Priority Date	Broadest Claim	Government Rights
US 2010-0291666 (pending) Child: • 12/826,450 (patented, issued as US 8,048,633); • 12/846,609 (patented, issued as US 8,017,340)	Molecular Diagnostics System and Methods	Abbott Point of Care, Inc.	12/21/05	12/23/04	1. An integrated single-use device for performing a nucleic acid analysis, comprising: a housing, an entry port for accepting a sample suspected of containing a target nucleic acid, a first chamber operably connected to the entry port containing a reagent for extracting the target nucleic acid, a first conduit permitting passage of extracted nucleic acid into an amplification chamber, said housing containing an amplification reagent that is capable of incorporating a detectable label into an amplified nucleic acid target, the amplification chamber having a heating means and a temperature sensing means for controlling amplification conditions, the amplification chamber being operably linked to a second conduit containing a sensing region with an immobilized capture oligonucleotide, said housing containing a means for moving the amplified target to the sensing region to permit binding of said amplified target to said capture oligonucleotide, said second conduit operably attached to a holding chamber containing a fluid able to substantially displace uncaptured amplified target from the sensing region and permitting sensing of said detectable label retained in said sensing region.	None found.
US 2010-0047774 (pending)	Cartridge, System, and Method for Automated Medical Diagnostics	Koninklijke Philips Electronics, N.V.	06/16/06	06/23/05	1. A cartridge for the detection of the presence, absence and/or amount of a target nucleotide sequence in a sample comprising one or more nucleic acid sequences, characterized in that the cartridge comprises a generic part and one or more separate application-specific parts, which are connectable to the generic part.	None found.
US 8,703,476	Cartridge for Automated Medical	Biocartis Sa	06/26/06	06/30/05	1. A cartridge for the detection of the presence, absence and/or amount of a target nucleotide sequence in a sample comprising one or more nucleic acid sequences, the cartridge comprising:	None found.

	Diagnostics				a first component for processing a fluid having a sample, said first component including: one or more processing chambers, a first fluid opening for fluid access to at least one of said processing chambers of the first component, and a first sealing surface associated with the first fluid opening; a second component connectable to the first component for processing the fluid, said second component including: one or more processing chambers, a second fluid opening for fluid access to at least one of said processing chambers of the second component, said second fluid opening formed in a flexible portion of the second component that is at least flexible in a direction perpendicular to the second sealing surface, and a second sealing surface associated with the second fluid opening, the first and second components are moveable relative to each other when the first component is connected to the second component to selectively position the first and second fluid openings in (i) an open fluid communication position, wherein the first fluid opening is generally aligned with the second fluid opening to allow the fluid to move between the first component and the second component, and (ii) a closed fluid communication position, wherein the first fluid opening is unaligned with the second fluid opening to prevent the fluid from moving between the first component and the second component; and a biaser for biasing the second sealing surface toward the first sealing surface to engage the second sealing surface with the first sealing surface to provide a sealed fluid pathway between the first and second components, thereby preventing fluid from leaking external to said cartridge.	
US 6,374,684	Fluid Control and Processing System	Cepheid	08/25/00	08/25/00	1. A fluid control and processing system comprising: a housing having a plurality of chambers; and	None found.

					a valve body including a fluid sample processing region continuously coupled fluidicly with a fluid displacement region, the fluid displacement region being depressurizable to draw fluid into the fluid displacement region and pressurizable to expel fluid from the fluid displacement region, the valve body including a plurality of external ports, the fluid sample processing region including a plurality of fluid processing ports each fluidicly coupled with one of the external ports, the fluid displacement region being fluidicly coupled with at least one of the external ports, and the valve body being adjustable with respect to the housing to allow the external ports to be placed selectively in fluidic communication with the plurality of chambers.	
US 2009-0298059 (pending)	System for the Integrated and Automated Analysis of DNA or Protein and Method for Operating Said Type of System	Boehringer Ingelheim Vetmedica GMBH	05/22/06	05/25/05	1. A system for the integrated and automated analysis of DNA or protein, comprising: a cartridge to receive a sample and various reagents suitable for the analysis in dry and long-term-stable form; an evaluation device, containing a control device to perform an analysis process when the cartridge is introduced into the evaluation device; means for processing the sample within the cartridge, for which purpose liquid from a liquid container is fed at least to the dry reagents in the cartridge for the purpose of dissolving and subsequently detecting sample constituents to be detected; first means for controlling introduction of the cartridge into the analysis device and the subsequent analysis process proceeding in the cartridge including movement and thermostatic regulation of liquids introduced into the cartridge; and second means for processing signals obtained through the analysis process are present, the first and second means, in the control device, being coordinated with one another in such a way that the analysis process of the sample can be carried out in a fully integrated manner and the signals are directly outputtable.	None found.

SKGF Term Search #2: "automated" "diagnostic" "cartridge" "integrated" "PCR" "government"

Relevant Patents/Applications –

Patent/Application No.	Title	Assignee	Filing Date	Priority Date	Broadest Claim	Government Rights
US 8,222,023 Child: • 13/492,612 (patented, issued as US 8,772,017)	Integrated Nucleic Acid Assays	Micronics, Inc.	09/10/08	03/15/06	1. An apparatus for performing a nucleic acid assay on a biological sample, said apparatus comprising: (a) a plastic disposable cartridge body with external surface, said body containing dry and fluid reagents for said nucleic acid assay, wherein said cartridge body comprises: (i) a first fluidic subcircuit for extracting a nucleic acid from said sample; (ii) a second fluidic subcircuit for synthesizing an amplicon product, wherein said second fluidic subcircuit is configured for receiving said nucleic acids from said first fluidic subcircuit; (iii) a third fluidic subcircuit for detecting said amplicon product, wherein said third fluidic subcircuit is configured for receiving said amplicon product from said second fluidic subcircuit; (iv) a sanitary waste collection chamber having a fluid inlet and valve with fluidic connection to said first fluidic circuit, a bibulous pad within said chamber, and a film covering said bibulous pad and separating said fluid inlet from an outside vent, said outside vent for venting said chamber through said external surface; and (v) a pneumatic interconnect subcircuit with control arms for pneumatically actuating said first, second and third fluidic subcircuits; and (b) an off-cartridge pneumatic actuation manifold configured with pneumatic interface to said cartridge body and programmed to actuate said first, second and third fluidic subcircuits according to a train of positive and negative pneumatic pressure pulses delivered to said pneumatic interconnect subcircuit under control of a microprocessor.	This invention was made with government support under Contract No. UO1 AI061187, awarded by the National Institutes of Health. The government has certain rights in this invention.
US 6,197,595	Integrated Nucleic Acid	Affymetrix, Inc.	04/19/99	06/29/95	1. A method of directing a fluid sample in a miniature fluidic system, comprising:	The present invention was

Parent: • CIP of 09/210,025 (patented, issued as US 6,043,080); • Division of 08/671,928 (patented, issued as US 5,922,591); • CIP of 08/589,027 (patented, issued as US 5,856,174) Child: • 09/751,658 (patented, issued as US 6,830,936); • 11/010,841 (abandoned); • 09/523,417 (patented, issued as US 6,326,211)	Diagnostic Device				providing a microfabricated device having at least first and second chambers disposed therein, wherein each of said at least first and second chambers is in fluid connection with a common chamber or channel, has at least first and second controllable valves disposed across said fluid connection, respectively, and wherein at least one of said first and second chambers include a vent; applying a positive pressure to said common chamber or channel; selectively opening said at least first controllable valve, whereby said positive pressure forces said fluid sample from said common chamber or channel into said first chamber.	made with U.S Government support under ATP Grant No. 70NANB5H1031. The government has certain rights in this invention.
US 8,101,431	Integration of Fluids and Reagents into Self-Contained Cartridges Containing Sensor Elements and Reagent Delivery Systems	Board of Regents, The University of Texas System	12/22/04	02/27/04	1. A system for detecting analytes in a sample comprising: (a) a cartridge, comprising a particle-based detection system and a membrane-based detection system, wherein: (i) the particle detection system is configured to produce a signal, when in the presence of an analyte, from an individual particle positioned in an individual cavity at an individually addressable position in the particle detection system and the membrane detection system is configured for analysis of microbes or cells captured on a membrane, (ii) an integrated waste reservoir that collects reagent and/or sample during use,	None found.

					(iii) a trap coupled to a fluid delivery system and configured to at least partially remove air from the sample, thereby reducing air bubbles within the sample, and (iv) a reagent delivery system disposed in or on the cartridge, the reagent delivery system comprising one or more reagents in a substantially sealed reservoir, and wherein the reagent delivery system is configured to deliver one or more reagents to the sample during use; and (b) an optical platform, wherein the optical platform is configured to detect a signal produced by the interaction of the sample and/or analyte with the particle detection system or the membrane detection system during use.	
US 6,126,804 (Expired Due to Nonpayment of Maintenance Fee)	Integrated Polymerase Chain Reaction/Electrophoresis Instrument	The Regents of the University of California	09/23/97	09/23/97	1. An integrated polymerase chain reaction/capillary electrophoresis instrument, comprising: a substrate; said substrate containing at least one capillary column formed therein; said at least one capillary column including end sections having a cross-section smaller than a main section thereof; said substrate including at least one well for polymerase chain reactions located adjacent one end of said capillary column; said substrate including at least one well for capillary electrophoresis buffer material located adjacent said one end of said capillary column; said substrate including a passageway interconnecting said wells and said one end of said capillary column located intermediate said wells; means for providing electrical power to said wells and said capillary column; and means for detecting material passing through said at least one capillary column.	The United States Government has rights in this invention pursuant to Contract No. W-7405-ENG-48 between the United States Department of Energy and the University of California for the operation of Lawrence Livermore National Laboratory.
US 8,562,918	Universal Sample	Integenx Inc.	12/17/12	06/05/09	1. A system configured to perform a method comprising:	This invention was made with

Parent: • Division of 12/795,515 (patented, issued as US 8,394,642) Child: • 13/967,957 (pending)	Preparation System and Use in an Integrated Analysis System				extracting DNA from a sample; isolating the extracted DNA; amplifying a plurality of short tandem repeat (STR) markers of the isolated DNA; separating a plurality of amplified STR markers by electrophoresis; detecting a plurality of separated STR markers; and performing computer analysis of a plurality of detected STR markers to produce a computer file identifying a plurality of detected STR markers; wherein the method is performed in less than 4 hours; and wherein the system comprises: a) a sample preparation module adapted to extract DNA from a sample in a non-microfluidic volume, to isolate the extracted DNA by capture of the extracted DNA to particles, and to move the particles comprising isolated DNA through a first microfluidic channel; b) a reaction module comprising a reaction chamber in fluidic communication with the first microfluidic channel and adapted to immobilize the particles comprising isolated DNA and to perform an amplification reaction on the isolated DNA to produce a reaction product; c) a separation and detection module in fluidic communication with the reaction chamber and adapted to separate the reaction product by electrophoresis and to detect the separated reaction product; and d) a data analysis module adapted to receive data on the separation and detection of the reaction product from the separation and detection module and comprising computer-executable code that transforms the data and produces a computer file identifying the separated and detected reaction product; wherein the sample preparation module and the reaction module are integrated in a disposable cartridge comprising:	Government support under Contract No. 2004*H838109*000 awarded by the Central Intelligence Agency. The Government may have certain rights in this invention.

					i) at least one set of fluidic chambers comprising a sample chamber, a capture chamber and a reaction chamber adapted for thermal cycling, wherein the chambers are in fluidic communication with each other; and ii) a reagent cartridge comprising reagents for performing an amplification reaction involving thermal cycling, wherein the reagent cartridge is configured to be carried on the disposable cartridge in a closed configuration and to be placed into fluidic communication with the at least one set of fluidic chambers.	

Search Strategy –

SKGF Term Search #1:

- The following terms were used: "automated"; "diagnostic"; "cartridge"; "integrated"; and "PCR."
- The search was restricted to US Utility patents.
- There were 27,600 total hits from the search. These hits were further narrowed down based on the title. Where the title appeared relevant, the patent/applications were read in greater detail to determine their relevancy.

SKGF Term Search #2:

- The following terms were used: "automated"; "diagnostic"; "cartridge"; "integrated"; "PCR"; and "government."
- The search was restricted to US Utility patents.
- There were 11,600 total hits from the search. These hits were further narrowed down based on the title. Where the title appeared relevant, the patent/applications were read in greater detail to determine their relevancy.