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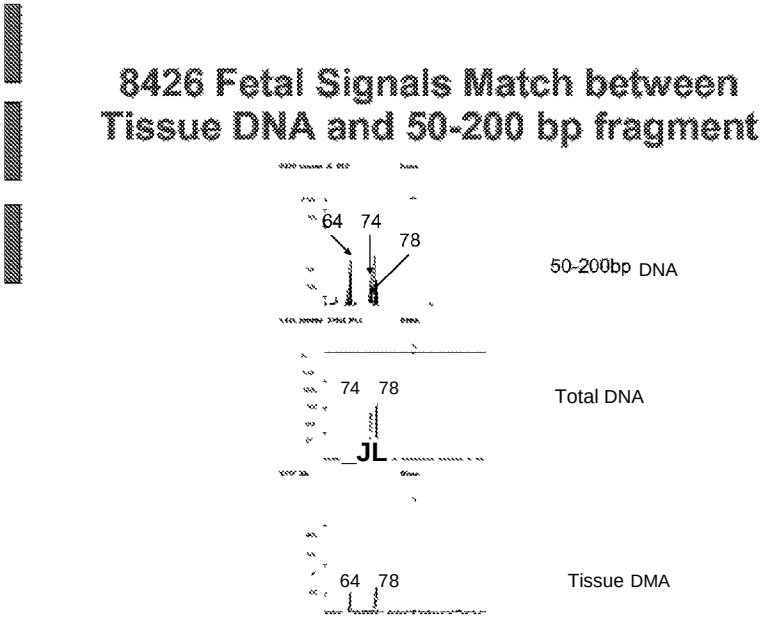

(57) Abstract: The present invention provides methods and kits useful for genetic testing or screening of fetuses using nucleic acid samples isolated from cervical mucus samples of fetus hosts.

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NON-ÏNVASIVE PRENATAL GENETIC SCREEN

FIELD OF THE INVENTION

[0001] This invention relates generally to the isolation of fetal nucleic acid and prenatal screening or testing of genetic and chromosomal abnormalities.

BACKGROUND OF THE INVENTION

[0002J Prenatal testing or screening is usually performed to determine the gender of the fetus or to detect genetic disorders and/or chromosomal abnormalities in the fetus during pregnancy. As of today, over 4000 genetic disorders, caused by one or more faulty genes, have been recognized. Some examples include Cystic Fibrosis, Huntington's Disease, Beta Thalassaemia, Myotonic Dystrophy, Sickle Cell Anemia, Porphyria, and Fragile-X-Syndrome. Chromosomal abnormality is caused by aberrations in chromosome numbers, duplication or absence of chromosomal material, and by defects in chromosome structure. Some examples of chromosomal abnormalities are trisomies, namely trisomy 16 , a major cause of miscarriage in the first trimester, trisomy 2 1 (Down syndrome), trisomy 13 (Patau syndrome), trisomy 18 (Edwards syndrome), Klinefelter's syndrome (47, XXY), (47, XYY), and (47, XXX); the absence of chromosomes (monosomy), *e.g.*, Turner syndrome (45, XO); chromosomal translocations, deletions and/or microdeletions, *e.g.*, Robertsonian translocation, Angelman syndrome, DiGeorge syndrome and Wolf-Hirschhorn Syndrome.

[0003] Currently available prenatal genetic tests usually involve invasive procedures. For example, chorionic villous sampling (CVS) performed on a pregnant woman around 10-12 weeks into the pregnancy and amniocentesis performed at around 14-16 weeks all contain invasive procedures to obtain the sample for testing chromosomal abnormalities in a fetus. Fetal cells obtained via these sampling procedures are usually tested for chromosomal abnormalities using cytogenetic or fluorescent in situ hybridization (FISH) analyses.

[0004] While these procedures can be useful for detecting chromosomal aberrations, they have been shown to be associated with the risk of miscarriage. Therefore amniocentesis or CVS is only offered to women perceived to be at increased risk, including those of advanced maternal age (>35 years), those with abnormal maternal serum screening or those who have had a previous fetal chromosomal abnormality. As a result of these tests the percentage of women over the age of 35 who give birth to babies with chromosomal

aberrations such as Down syndrome has drastically reduced. However, lack of appropriate or relatively safe prenatal testing or screening for the majority of pregnant women has resulted in about 80% of Down syndrome babies born to women under 35 years of age.

[0005] Thus there is a need for diagnostic screening tests for the general population of pregnant women, especially tests directed to identifying fetal chromosomal aberrations as well as other genetic variations or defects.

SUMMARY OF THE INVENTION

[0006] The present invention is based, in part, on the discovery that cervical mucous is a good natural reservoir for migrated placental cells, *e.g.,* fetal cells as well as for isolating fetal nucleic acids. Accordingly the present invention provides methods and kits useful for testing or screening for genetic abnormalities in fetuses using fetal nucleic acids isolated from cervical mucus samples. In addition, the present invention provides primers and probes useful for nucleic acid amplification of, *e.g.*, genetic markers, especially using relatively small size amplicons in fetal genetic screening.

[0007] In one embodiment of the invention, it provides a method for conducting a genetic test of a fetus. The method comprises isolating a nucleic acid sample from a cervical mucus sample obtained from a female subject containing the fetus, wherein the nucleic acid sample consists essentially of polynucleotides in a size ranging from about 50 base pairs to about 300 base pairs and wherein the result of a genetic test on the nucleic acid sample is indicative of a genetic composition of the fetus.

[0008] In another embodiment of the invention, it provides a method of isolating a fetal nucleic acid sample. The method comprises isolating a nucleic acid sample consisting essentially of polynucleotides of about 50 base pairs to about 300 base pairs in length from a cervical mucus sample obtained from a female subject containing the fetus.

[0009] In yet another embodiment of the invention, it provides a genetic testing kit suitable for testing the genetic composition of a fetus. The kit comprises a pair of primers suitable for amplifying a desired allele or genetic marker, wherein the amplified nucleotide fragment is less than about 200 base pairs and wherein the desired allele is not uniquely associated with the Y chromosome. In other embodiments, the kit comprises an isolated DNA sample from a cervical mucus sample obtained from a female subject containing the fetus. The DNA sample consists essentially of polynucleotides in a size ranging from about 50 base pairs to about 200 base pairs.

[0010] In still another embodiment of the invention, it provides an isolated DNA sample useful for genetic testing of a fetus. The DNA sample can be obtained by isolating DNA fragments in a size ranging from about 50 base pairs to about 200 base pairs from a cervical mucus sample obtained from a female subject containing the fetus.

BRIEF DESCRIPTION OF THE FIGURES

[0011] FIG. 1 shows the size fractionation of total DNA obtained from cervical mucus on a 10% polyacrylamide gel. "Band A," corresponding to a polynucleotide length of around 50-200 base pairs contains fetal DNA.

[0012] FIG. 2 shows an example of PCR electropherogram demonstrating that in one experiment the fetal signals match between fetal tissue DNA and the 50-200 bp fragment of DNA isolated from a cervical mucus sample.

[0013] FIG. 3 shows another example of PCR electropherogram demonstrating that in another experiment the fetal signals match between fetal tissue DNA and the 50-200 bp fragment of DNA isolated from a cervical mucus sample.

DETAILED DESCRIPTION OF THE INVENTION

[0014] It is the discovery of the present invention that cervical mucus samples can be a great source for fetal cells as well as fetal nucleic acids. Accordingly, the present invention provides methods, reagents and kits useful for testing or screening fetus for genetic abnormalities using nucleic acids isolated from cervical mucus samples.

[0015] In addition, the present invention provides primers and probes useful for nucleic acid amplification, *e.g.*, of genetic markers, especially using relatively small size amplicons in fetal genetic screening.

[0016] According to one aspect of the present invention, it provides methods for conducting genetic tests of a fetus by isolating one or more nucleic acid samples from one or more cervical mucus samples obtained from a female subject containing the fetus. In general, the nucleic acid sample useful for the methods of the present invention can be a DNA sample, RNA sample, or a combination thereof including any DNA, **cDNA.** or RNA derived from one or more nucleic acid samples isolated from one or more cervical mucus samples.

[0017] In one embodiment the nucleic acid sample useful for the methods of the present invention is a DNA sample. In another embodiment, the nucleic acid sample useful for the methods of the present invention is substantially free of proteins or polypeptides. In

yet another embodiment, the nucleic acid sample useful for the methods of the present invention is isolated by any known or later discovered size fractionation method including, but not limited to, gel electrophoresis, capillary electrophoresis, size exclusion matrixes, and size fractionation columns.

[0018] In still another embodiment, the nucleic acid sample useful for the methods of the present invention is in a size range representative of, or substantially associated, with fetal nucleic acid. In still another embodiment, the nucleic acid sample useful for the methods of the present invention is in a size range substantially free of nucleic acid from the host of the fetus. For example, the nucleic acid sample useful for the methods of the present invention can be in a size range from about 50 to about 1000 base pairs, from about 50 to about 500 base pairs, from about 50 to about 400 base pairs, from about 50 to about 300 base pairs, from about 50 to about 250 base pairs, from about 50 to about 200 base pairs, from about 50 to about 150 base pairs, or from about 50 to about 100 base pairs or a combination thereof, and optionally, does not contain a substantial amount, *e.g.,* more than 0.5%, 1%, 2%, 3%, 4%, or 5% of nucleic acids from any other size range or source.

[0019] According to the present invention, the nucleic acid sample useful for the methods of the present invention can be isolated from a cervical mucus sample from the host of a fetus, *e.g.,* a pregnant woman. The cervical mucus sample of the present invention can be obtained from the host of a fetus, at any time during the pregnancy, for example, during the first or second trimester, by any means now known or later discovered in the art. In general, a cervical mucus sample, *e.g.,* an endocervical mucus sample, can be obtained using techniques such as transcervical swabs, endocervical lavage, scrapes, cytobrush, aspiration, intrauterine lavage, or a combination thereof.

[0020] In one embodiment, the cervical mucus sample of the present invention is a fresh sample, *e.g.,* without substantial preservation or processing. In another embodiment, the cervical mucus sample is a sample preserved from a fresh sample, *e.g.,* preserved in a suitable aqueous preservation or transportation medium, or alternatively, a sample of a medium containing nucleic acids leached from one or more cervical mucus samples. Without being bound to any theory, it is believed that nucleic acid will diffuse out from the cervical mucus into a fluid that is in contact with the mucus. Fetal nucleic acid will thus be present both in the cervical mucus sample as well as in the media in which the sample is stored and/or transported. Accordingly, the nucleic acid sample useful for the methods of the present invention can be obtained directly from the cervical mucus sample, or from the medium, for example, preservation medium, transportation medium, or any aqueous medium.

that is in contact with the cervical mucus. Examples of transportation media include, but are not limited to, any tissue culture medium known to one of skill in the art. *e.g.,* RPMI-1640 medium. In yet another embodiment, the cervical mucus sample of the present invention is maintained or stored between about 4^0C and about $2O^0$C, *e.g.,* in a low calcium basal medium.

[0021] In still another embodiment, the cervical mucus sample of the present invention is a treated sample, *e.g.,* a fresh sample or preserved sample treated with any suitable reagent(s) to facilitate mucous dissolution which in turn, assists in isolation of nucleic acid components from the sample. For example, the cervical mucus sample can be a sample treated with mucolytic agent(s) or mucinase(s), *e.g.,* N-acetyl-L-cysteine, L-cysteine, dithiothreitol (DTT), brornhexine hydrochloride, and any of the hyaluronidases, including hyaluronate lyase, hyaluronoglucosarninidase, and hyalurongluc uronidase. In another example, the cervical mucus sample of the present invention is a sample treated with enzyme(s), *e.g.,* sugar hydrolysis enzyme(s) such as β-galactosidase or invertase, or proteinase, or pepsin or combinations thereof. The cervical mucus sample may also be treated with chemicals known in the art to induce apoptosis to release fetal nucleic acid.

[0022] In another embodiment, the cervical mucus sample of the present invention is a sample treated to enrich fetal nucleic acid and/or reduce maternal nucleic acid content. For example, the cervical mucus sample can be treated to reduce or degrade any nucleic acid, *e.g.,* DNA that is characteristic of maternal DNA. One of such nucleic acid is hypermethylated maternal DNA. Any means to reduce, degrade, or selectively remove hypermethylated maternal DNA can be used including, without any limitation, methylation specific restriction enzymes such as McrBC (BioLabs), antibodies specific for hypermethylated maternal DNA such as anti-5'-methyl-cytosine antibodies and/or anti-methylCpG binding protein-2 (MeCP2) antibodies, or ligands or proteins such as MeCP2 that specifically bind methylated CpG islands in maternal DNA.

[0023] Alternatively fetal nucleic acid can be enriched using markers specific for fetal nucleic acids. For example, hypomethylated maspin DNA can be used as a marker for fetal DNA. In one instance, one can treat total cervical mucous DNA with sodium bisulfite, which can induce chemical changes in the hypomethylated fetal DNA whereby unmethylated cytosine of fetal DNA is converted into uridine (U). Such change can be used to preferentially isolate or enrich fetal DNA, *e.g.,* to preferentially amplify fetal DNA containing uridine(s) converted from cytosine(s).

[0024] According to the present invention, the nucleic acid sample of the present invention can be used to conduct genetic tests or screening of a fetus. In particular, the nucleic acid sample of the present invention can be used to test or screen the genetic composition of a fetus, *e.g.*, chromosomal composition, gene composition, or genetic marker or finger printing pattern of a fetus. In one embodiment, testing or screening a genetic composition of a fetus includes probing for chromosomal abnormalities including, without any limitation, monosomy, partial monosomy, trisomy, partial trisomy, chromosomal translocation, chromosomal duplication, chromosomal deletion or microdeletion, and chromosomal inversion.

[0025] In general, the term "monosomy" refers to the presence of only one chromosome from a pair of chromosomes. Monosomy is a type of aneuploidy. Partial monosomy occurs when the long or short arm of a chromosome is missing. Common human genetic disorders arising from monosomy include: XO, only one X chromosome instead of the usual two (XX) seen in a normal female (also known as Turner syndrome); cri du chat syndrome, a partial monosomy caused by a deletion of the end of the short p (from the word petit, French for small) arm of chromosome 5; and Ip36 Deletion Syndrome, a partial monosomy caused by a deletion at the end of the short p arm of chromosome 1.

[0026] In contrast, the term "trisomy" refers to the presence of three, instead of the normal two, chromosomes of a particular numbered type in an organism. Thus the presence of an extra chromosome 21 is called trisomy 21. Most trisomies, like most other abnormalities in chromosome number, result in distinctive birth defects. Many trisomies result in miscarriage or death at an early age. A partial trisomy occurs when part of an extra chromosome is attached to one of the other chromosomes, or if one of the chromosomes has two copies of part of its chromosome. A mosaic trisomy is a condition where extra chromosomal material exists in only some of the organism's cells. While a trisomy can occur with any chromosome, few babies survive to birth with most trisomies. The most common types that survive without spontaneous abortion in humans include: Trisomy 21 (Down syndrome); Trisomy 18 (Edwards syndrome); Trisomy 13 (Patau syndrome): Trisomy 9; Trisomy 8 (Warkany syndrome 2): Trisomy 16 (which is the most common trisomy in humans, occurring in more than 1% of pregnancies. This condition, however, usually results in spontaneous miscarriage in the first trimester). Trisomy involving sex chromosomes include: XXX (Triple X syndrome); XXY (Klinefelter's syndrome); and XYY (XYY syndrome).

[0027J In another embodiment, testing or screening a genetic composition of a fetus includes probing for allele or gene abnormalities, *e.g.,* one or more mutations such as point mutations, insertions, deletions in one or more genes.

[0028] In yet another embodiment. testing or screening a genetic composition of a fetus includes probing for one or more polymorphism patterns or genetic markers, *e.g.,* short tandem repeat sequences (STRs), single nucleotide polymorphisms (SNPs). etc.

[0029] In still another embodiment, testing or screening a genetic composition of a fetus includes probing for any genetic abnormality corresponding to or associated with a condition or disorder, *e.g.,* Cystic Fibrosis, Sickle-Cell Anemia, Phenylketonuria, Tay-Scahs Disease, Adrenal Hyperplasia, Fanconi Anemia, Spinal Muscularatrophy, Duchenne's Muscular Dystrophy, Huntington's Disease, Beta Thalassaemia, Myotonic Dystrophy, Fragile-X Syndrome, Down Syndrome, Edwards Syndrome, Patau Syndrome, Klinefelter's Syndrome, Triple X syndrome, XYY syndrome. Trisomy 8, Trisomy 16, Turner Syndrome, Robertsonian translocation, Angelman syndrome, DiGeorge Syndrome, Wolf-Hirschhorn Syndrome, RhD Syndrome, Tuberous Sclerosis, Ataxia Telangieltasia, and Prader-Willi syndrome. .

[0030] In still another embodiment, testing or screening a genetic composition of a fetus includes probing for any genetic abnormality that is not uniquely associated with Y chromosome.

[0031] In still another embodiment, testing or screening a genetic composition of a fetus includes probing for any genetic condition corresponding to or associated with gender or paternity of the fetus.

[0032] Usually genetic tests provided by the present invention use the nucleic acid sample of the present invention either directly or as templates for "amplification-based" genetic composition testing assays, including without any limitation. polymerase chain reaction ("PCR"), real-time polymerase chain reaction ("RT-PCR"), ligase chain reaction ("LCR"), self-sustained sequence replication ("3SR") also known as nucleic acid sequence based amplification ("NASBA"), Q-B-Replicase amplification, rolling circle amplification ("RCA"). transcription mediated amplification ("TMA"). linker-aided DNA amplification ("LADA"), multiple displacement amplification ("MDA"). invader and strand displacement amplification ("SDA"). Amplification of a nucleotide fragment using a pair of primers specific for an allele indicates the presence of the allele.

[0033] In one embodiment, the "amplification-based" genetic composition testing assays of the present invention include using primers to generate amplicons less than about

200 base pairs, less than about 150 base pairs, or between about 75 to about 150 base pairs. Exemplary primers of the invention used in the amplification-based assays are provided herein. In one embodiment, the primers of the invention include, but are not limited to, the pairs of primers of SEQ ID NOs: 1 and 2; SEQ ID NOs: 3 and 4; SEQ ID NOs: 5 and 6; SEQ ID NOs: 9 and 10; SEQ ID NOs: 11 and 12; and SEQ ID NOs: 13 and 14. In another embodiment, exemplary primers of the invention include, but are not limited to, the primer sets listed in Tables 2, 3, 4 and 5.

[0034] According to another aspect of the present invention, it provides a method of isolating a fetal nucleic acid sample. The method comprises isolating one or more nucleic acid samples from a cervical mucus sample obtained from a maternal host of a fetus in a size range enriched with fetal nucleic acids. Examples of such size range include without any limitation from about 50 to about 1000 base pairs, from about 50 to about 500 base pairs, from about 50 to about 400 base pairs, from about 50 to about 300 base pairs, from about 50 to about 250 base pairs, from about 50 to about 200 base pairs, from about 50 to about 150 base pairs, or from about 50 to about 100 base pairs or a combination thereof. In one embodiment, the nucleic acid sample does not contain a substantial amount, *e.g.*, more than 0.5%, 1%, 2%, 3%, 4%, or 5% of nucleic acids from any other size range or source.

[0035] According to yet another aspect of the present invention, it provides an isolated nucleic acid sample useful for genetic testing of a fetus. The nucleic acid sample, *e.g.*, a DNA sample, can be obtained by isolating nucleic acid fragments of from about 50 base pairs to about 100, 200, 300, 400, 500, or 1000 base pairs in length from a cervical mucus sample obtained from a female subject containing the fetus. In one embodiment, these nucleic acid fragments are obtained from the total nucleic acid isolated from the cervical mucus sample by a size fractionation method. In another embodiment, the isolated nucleic acid is substantially free of non-nucleic acid components.

[0036] According to still another aspect of the present invention, it provides kits useful for genetic testing or screening of a fetus. In one embodiment, the kit provided by the present invention contains one or more pairs of primers useful for genetic composition testing assays and optionally one or more probes useful for detecting the amplified product(s) by the primers. In another embodiment, the kit provided by the present invention contains one or more pairs of primers useful for testing one or more polymorphisms or genetic markers of a fetus. In yet another embodiment the kit provided by the present invention contains one or more pairs of primers which are useful for generating amplicons less than about 200 base pairs, less than about 150 base pairs, or between about 75 to about 150 base pairs. In still

another embodiment, the kit provided by the present invention contains one or more pairs of primers for one or more designated chromosomes and the primers are selected from the primer sets listed in Tables 2, 3, 4 or 5. In a further embodiment, the kit of the invention contains the pairs of primers of SEQ ID NOs: 1 and 2; SEQ ID NOs: 3 and 4; SEQ ID NOs: 5 and 6; SEQ ID NOs: 9 and 10; SEQ ID NOs: 11 and 12; SEQ ID NOs: 13 and 14; or a combination thereof. The kit can also optionally contain one or more probes and/or other suitable reagents useful for detecting the amplified product(s) by the primers. Further, the kit can comprise instructions for using the pair of primers to test the genetic composition of a fetus.

[0037] In still another embodiment, the kit of the present invention contains one or more nucleic acid samples of the present invention. In a further embodiment, the kit provided by the present invention contains the cervical mucus sample of the present invention and an instruction for isolating the nucleic acid sample of the present invention from the cervical mucus sample.

EXAMPLES

[0038J The following examples are intended to illustrate but not to limit the invention in any manner, shape, or form, either explicitly or implicitly. While they are typical of those that might be used, other procedures, methodologies, or techniques known to those skilled in the art may alternatively be used.

Example 1

[0039] This Example describes the collection and isolation of fetal DNA from pregnant women.

[0040] Cervical mucous samples were collected from patients, after due consent, by cytobrush method. In the cytobrush method, a Pap smear cytobrush *(e.g.,* MedScand-AB. Malmo, Sweden) was inserted to a maximum depth of 2 cm and removed while rotating it a full turn *(i.e.,* 360°). In order to remove the transcervical cells caught on the brush, the brush was shaken into a test tube containing 2-3 ml of a tissue culture medium (e.g.. RPMI- 1640 medium, available ATCC, Virginia) in the presence of 1% Penicillin Streptomycin antibiotic. In order to concentrate the transcervical cells on microscopic slides cytospin slides were prepared using *e.g.*. a Cytofunnel Chamber Cytocentrifuge (Thermø-Shandon, England). The conditions used for cytocentrifugation are dependent on the murkiness of the transcervical

specimen; if the specimen contained only a few cells, the cells are first centrifuged for five minutes and then suspended with 1 ml of fresh medium. Once prepared, the cytospin slides can be kept in 95% alcohol until further use.

[0041] DNA was extracted from fetal tissues, mucous samples or the transport media using Roche's Apoptotic DNA-Ladder Kit following manufacturer's protocol with slight modification. Mucous samples were incubated with equal volume of lysis buffer for 30 minutes to 2 hours or until all the mucous had been dissolved. Some samples needed to be homogenized with a 2 1 gauze 1.5 inch long needle to facilitate complete mucous dissolution. Total mucous DNA was then size fractionated on 10% PAGE, also known as 10% TBE gel (Invitrogen) under non-denaturing conditions, and the small, 100-250 base pair long DNA band (see Figure 1) was sliced out after staining the gel with SYBR Gold stain. Fetal DNA from the gel was extracted by soaking the crushed gel in 0.3M sodium acetate (pH 5.5) at 37^0C for overnight followed by desalting the DNA using Promega's Wizard SV Genomic DNA Purification kit.

Example 2

[0042] This Example demonstrates that the DNA obtained from the cervical mucous samples after PAGE purification is indeed fetal DNA.

[0043] The total DNA obtained from the cervical swap was size fractionated on 10% PAGE, and the small, 50-250 base pair DNA band (see Figure 1) was sliced out. The DNA was extracted from PAGE using Promega's Membrane Binding buffer, and its concentration was determined by NanoDrop-1000 Spectrophotometer.

[0044] 10-20 ng of this size-fractionated DNA was amplified by PCR with primers designed to amplify short STR regions *(e.g.,* D22S1045, CSFlPO, D2S441 see Table 1 for detail).

[0045] Typical PCR reaction components were;

1O mM dNTP	2.0 µi
25 mM MgC12	1.5 µl
50 mM Primers	0.5 µl
Template lµg"µl	2.0 µl
Arnpli Taq Gold	0.5 µl
1OX PCR Buffer	2.5 µl
Water	16.0 µl

[0046J Typical PCR cycle consisted of: Denaturation temperature of 94 ^{0}C for 30 sec, annealing temperature varied from 56 to 62°C depending upon the primer length, extension was done at 72 ^{0}C. Number of cycles used ranged from 26 to 40.

[0047] These primers were also used for PCR reaction with the DNA extracted from fetal tissues and the total, unfractionated, mucous DNA. Shown in FlG. 2 and FIG. 3 are PCR electropherograms that demonstrating that the 50-200 base pair DNA fraction resulted in the same fetal alleles as seen in fetal tissue PCR.

Example 3

[0048J This Example demonstrates that the mini-STR markers detect fetal alleles.

[0049] Mini-STR markers of the invention were used to detect fetal alleles from DNA extracted from clinical cervical mucous samples. Table 1, below, summarizes the results obtained. D1S1677-F and -R, D22S1045-F and -R, D10S1248-F and –R, TPOX, Mini-LFG33-F and -R, and Mini-LFG34-F and -R are exemplary primers of the invention.

Table I: Detection of Fetal Allele from Clinical Cervical Mucus Samples

Sample ID	Sample Type	Gel Enriched	PCR Analysis					Presence of Fetal Allele
			Informative Primer Set	Sequence	Seq. ID No.	Maternal Alleles	Fetal Allele	
7601	Transport Media	8% PAGE	D1S1677-F	FAM-TTCTGTTGGTATAGAGCAGTGTTT	SEQ ID NO 1	90 21 94 91	99 91	Yes
			D1S1677-R	GTGACAGGAAGGACGAATG	SEQ ID NO 2			
7602	Transport Media		D22S1045-F	FAM-ATTTTCCCCGATGATAGTAGTCT	SEQ ID NO 3	95 11 97 81	85 61	Yes
			D22S1045-R	GCGAATGTATGATTGGCAATATTTTT	SEQ ID NO 4			
7604	Transport Media		D22S1045-F	FAM-ATTTTCCCCGATGATAGTAGTCT	SEQ ID NO 3	98 15 102 31	92 44	Yes
			D22S1045-R	GCGAATGTATGATTGGCAATATTTTT	SEQ ID NO 4			
			D10S1248-F	FAM-TTAATGAATTGAACAAATGAGTGAG	SEQ ID NO 5	104 21 111 12	10 6 55	
			D10S1248-R	GCAACTCTGGTTGTATTGTCTTCAT	SEQ ID NO 6			
7843	Transport Media		D10S1240-F	TAMRA-TCACCTGTCCCAGCTATCTG	SEQ ID NO 7	101 33 107 54	104 66	Yes
			D10S1240-R	AAAATTACTGGTACACTTGATAGCT	SEQ ID NO 8			
7845	Transport Media		D1S1677-F	FAM-TTCTGTTGGTATAGAGCAGTGTTT	SEQ ID NO 1	97 11 101 91	105 71	Yes
			D1S1677-R	GTGACAGGAAGGACGAATG	SEQ ID NO 2			
7846	Transport Media		D1S1677-F	FAM-TTCTGTTGGTATAGAGCAGTGTTT	SEQ ID NO 1	93 67 102 33	46 22	Yes
			D1S1677-R	GTGACAGGAAGGACGAATG	SEQ ID NO 2			
8034	Media		TPOX-F	NED-CTTAGGGAACCCTCACTGAATG	SEQ ID NO 9	148 55 156 34	160 32	Yes
			TPOX-R	GTCCTTGTCAGCGTTTATTTGC	SEQ ID NO 10			
8379	Mucus	10% PAGE	Profiler-F	commercially available from ABI		172 1 176	125 245	Yes
			Profiler-R	commercially available from ABI				
9558	Mucous	1 5% Agarose	Mini-LFG34-F	FAM-CACAAGGCAGAATAAAGGGA	SEQ ID NO 11	134 150	142	Yes
			Mini-LFG34-R	TTCATAGTCTGTCTTGTCTTGTCTCA	SEQ ID NO 12			
9560	Mucous	1 5 % Agarose	Mini-LFG33-F	TAMRA-CACCATACCCAGCCTTACTG	SEQ ID NO 13	118 122	116	Yes
			Mini-LFG33-R	CATGTTACTGTGCTGAATATTGTAGGC	SEQ ID NO 14			
9561	Mucous	1 5% Agarose	Mini-LFG34-F	FAM-CACAAGGCAGAATAAAGGGA	SEQ ID NO 13	135 150	146	Yes
			Mini-LFG34-R	TTCATAGTCTGTCTTGTCTTGTCTCA	SEQ ID NO 14			

Table 2: Mini-STR Primers for Chromosome 21

*Note * 6-FAM, VIC NED, JOE, ROX, PET, TAMRA or 5-FAM*

Number	Name/Loci	5' Label	Sequence	Seq. ID No.	Length	Chromosome
p21M-1	Mini LFG20-F	6-FAM	TTGAGAAGGCCCCACCTATG	SEQ ID NO 15	20	21
p21M-2	Mini LFG20-R		AGAAGGCCCCCTGTGTTATG	SEQ ID NO 16	20	21
p21M-3	Mini LFG21-F	HEX	GCGAATCATGACACTAATTTTGG	SEQ ID NO 17	23	21
p21M-4	Mini LFG21-R		TGGAGAAGAAAAAGAGGCCTGA	SEQ ID NO 18	22	21
p21M-5	Mint LFG24-F	NED	GGTTCTTTGGAAAATTGTTTAGGC	SEQ ID NO 19	24	21
p21M-6	Mini LFG24-R		TGCTCTGGACTTACAGCATCAA	SEQ ID NO 20	22	21
p21M-7	Mini LFG26-F	6-FAM	CCCTTAAAACCATATTTTTCACCTC	SEQ ID NO 21	25	21
p21M-8	Mini LFG26-R		AGCCTGGGTGACAGAGCAAG	SEQ ID NO 22	20	21
p21M-9	Mini LFG29-F	HEX	TTGCTTGAGAGGTAAAAAGAAAA	SEQ ID NO 23	23	21
p21M-10	Mini LFG29-R		GAGCAACAGAGCGAGATTCTG	SEQ ID NO 24	21	21
p21M-11	Mini LFG33-F	NED	CACCATACCCAGCCTTACTG	SEQ ID NO 25	20	21
p21M-12	Mini LFG33-R		CATGTTACTGTGCTGAATATTGTAGGC	SEQ ID NO 26	27	21
p21M-13	Mini LFG34-F	6-FAM	GGCAGAATAAAGGGATTATTGC	SEQ ID NO 27	22	21
p21M-14	Mini LFG34-R		TTCATAGTCTGTCTTGTCTTGTCTCA	SEQ ID NO 28	26	21
p21M-15	Mini D21S2054-F	NED	GCAGTAAATGTCTATGAAACAAGG	SEQ ID NO 29	24	21
p21M-16	Mini D21S2054-R		TGATAAATAGTGAATATAGTTGACAGC	SEQ ID NO 30	27	21
p21M-17	Mini D21S1904-F	*	CAACAATTCCTTCTAATTTTCCA	SEQ ID NO 31	23	21
p21M-18	Mini D21S1904-R		TGTCTGGTTTCCCCATCTCT	SEQ ID NO 32	20	21
p21 M-1 9	Mini D21S1911-F	*	TGAGGAGACATCCTTGACAAAA	SEQ ID NO 33	22	21
p21M-20	Mini D21S1911-R		CATACACACAGCAAGTATGAGTGA	SEQ ID NO 34	24	21
p21M-21	Mini D21S1256-F	*	GCCTATGGTCCCATCATAACA	SEQ ID NO 35	21	21
p21M-22	Mini D21S1256-R		TCCACAGTTCTTAGATGGCTTT	SEQ ID NO 36	22	21
p21M-23	Mini D21S1899-F	*	TGAAAACGTGTTGACAGATGAA	SEQ ID NO 37	22	21
p21M-24	Mini D21S1899-R		AATGGCAGGATTTTCTTTTT	SEQ ID NO 38	20	21
p21M-25	Mini D21S1922-F	*	TGTCAAAATATGTGGATTAGACAAAA	SEQ ID NO 39	26	21
p21 M-26	Mini D21S1922-R		TCACTGGTATACTGTGATGTGTGC	SEQ ID NO 40	24	21
p21 M-27	Mini D21S1884-F	*	AAAAATTATTGATAACGTTCAGTAT	SEQ ID NO 41	25	21
p21 M-28	Mini D21S1884-R		TTTCTAACAATATGTACCCACTGGA	SEQ ID NO 42	25	21
p21M-29	Mini D21S1914-F	*	CATTGGGCCTTCTGTCAAAT	SEQ ID NO 43	20	21
p21M-30	Mini D21S1914-R		TCTGCAGAATTTCATTTGCTGT	SEQ ID NO 44	22	21
p21M-31	Mini D21S263-F	*	CAAACTTGAAATATGAAAAAGTCATCA	SEQ ID NO 45	27	21
P21M-32	Mini D21S263-R		TTTCTGTATTTCCTGAAACAACATTT	SEQ ID NO 46	26	21

Number	Name/Loci	5' Label	Sequence	Seq. ID No.	Length	Chromosome
p21M-33	Mini D21S1252-F	*	TCTGTCTTTGTCTCACTATCTGTCTG	SEQ ID NO: 47	26	21
p21M-34	Mini D21S1252-R		TAGGGTGAGGACCCCTTTCT	SEQ ID NO: 48	20	21
p21M-35	Mini D21S1919-F	*	CCTGGATTATTTGTTCAAAGTCAG	SEQ ID NO: 49	24	21
p21M-36	Mini D21S1919-R		TCTCATGTTCCTTGGCCTGT	SEQ ID NO: 50	20	21
p21M-37	Mini D21S1255-F	*	ATTTTGCCACATAGAGAAAAATA	SEQ ID NO: 51	23	21
p21M-38	Mini D21S1255-R		GCCTGGACATCCTCTTTCT	SEQ ID NO: 52	19	21
p21M-39	Mini D21S266-F	*	AGATGTAGCACAGTTAGATGCAGA	SEQ ID NO: 53	24	21
p21M-40	Mini D21S266-R		AGCAGAAAAAGCCATTCTGG	SEQ ID NO: 54	20	21
p21M-41	Mini D21S2058-F	*	GTCATGACCCTGGCTGTG	SEQ ID NO: 55	18	21
p21M-42	Mini D21S2058-R		AGGGCAGGCTGTGCTCAT	SEQ ID NO: 56	18	21
p21M-43	Mini D2iS1431-F	*	GGGACCATTTTAGATATTCTGCT	SEQ ID NO: 57	23	21
p21M-44	Mini D21S1431-R		GCACTTAACAAGCACTGAATCAA	SEQ ID NO: 58	23	21
p21M-45	Mini D21S259-F	*	TCCTGAAGGAAGAATGTGGTC	SEQ ID NO: 59	21	21
p21M-46	Mini D21S259-R		ATGCATGGTCGTGTGTGTG	SEQ ID NO: 60	19	21
p21M-47	Mini D21S270-F	*	TTTTTCAAAATCAAAAAGATAGTGA	SEQ ID NO: 61	25	21
p21M-48	Mini D21S270-R		GGAGGGCATCTGGGTAATTT	SEQ ID NO: 62	20	21
p21M-49	Mini D21S1912-F	*	GCCATCAGCCCTCATACAGA	SEQ ID NO: 63	20	21
p21M-50	Mini D21S1912-R		GAATTTGGGGGACGCAGT	SEQ ID NO: 64	18	21
p21M-51	Mini D21S260-F	*	CGAGAAGTTTCCCATGCATTT	SEQ ID NO: 65	21	21
p21M-52	Mini D21S260-R		AAATTCAGTGATGGGAAGAAGG	SEQ ID NO: 66	22	21
p21M-53	Mini D21S261-F	*	CCTAAAACAGCATCAACAGAAA	SEQ ID NO: 67	22	21
p21M-54	Mini D21S261-R		TTGGACCTTTTGATTTTTCCT	SEQ ID NO: 68	21	21
p21M-55	Mini D21S262-F	*	CAGCAACTCCCACTTCTGAC	SEQ ID NO: 69	20	21
p21M-56	Mini D21S262-R		TTGTTGTTGAGTGAAAGAATAGAGAAA	SEQ ID NO: 70	27	21
p21M-57	Mini D21S1892-F	*	AAATCTGAATTATGTCCAATCAAAA	SEQ ID NO: 71	25	21
p21M-58	Mini D21S1892-R		TGAGTTTTTGGAAGAGAGAGAGAGA	SEQ ID NO: 72	25	21
p21M-59	Mini D21S272-F	*	AAAAGGGGATCCAATATGAAA	SEQ ID NO: 73	21	21
p21M-60	Mini D21S272-R		TGGAACAATTTTATCCTTAGTTTGTC	SEQ ID NO: 74	26	21
p21M-61	Mini D21S1893-F	*	TATGCACACCACACGGACAC	SEQ ID NO: 75	20	21
p21M-62	Mini D21S1893-R		GTTCCGGGGAAGTTTTATGC	SEQ ID NO: 76	20	21
p21M-63	Mini D21S265-F	*	TGGCAAAGAGAACAACAGCA	SEQ ID NO: 77	20	21
p21M-64	Mini D21S265-R		TTCTGTGAATATGGGTTCTGGA	SEQ ID NO: 78	22	21
p21M-65	Mini D2iS267-F	*	GGGGATTATTTATGTAGAAAATGAGA	SEQ ID NO: 79	26	21
p21M-66	Mini D21S267-R		GGTGACAGACCCTGTCTCTAAAA	SEQ ID NO: 80	23	21
p21M-67	Mini D2iS268-F	*	TGGGCAACAGAGTGAGACAG	SEQ ID NO: 81	20	21
p21M-68	Mini D21S268-R		CACATCCTTGCCAACACTTG	SEQ ID NO: 82	20	21

Number	Name/Loci	5' Label	Sequence	Seq. ID No.	Length	Chromosome
p21M-69	Mini D21S269-F	*	GATACTGAATCATCCCTTTCATTC	SEQ ID NO: 83	24	21
p21M-70	Mini D21S269-R		TTCCGTTATTAATTTTATTCTGAGG	SEQ ID NO: 84	25	21
p21M-71	Mini D21S1902-F	*	GAGTGAGAGACAGACAGAGAGACG	SEQ ID NO: 85	24	21
p21M-72	Mini D21S1902-R		CAGTAGGGGCAGACTATTTTACTC	SEQ ID NO: 86	24	21
p21M-73	Mini D21S1253-F	*	ATGGGTGACAGAGCGAGACT	SEQ ID NO: 87	20	21
P21M-74	Mini D21S1253-R		TTCAGAGCCTGGGTTAAACA	SEQ ID NO: 88	20	21
p21M-75	Mini D21S1254-F	*	AATGACCATCCTTAAAACAACTTT	SEQ ID NO: 89	24	21
p21M-76	Mini D21S1254-R		GTGGCTGAGCGAGACTCTGT	SEQ ID NO: 90	20	21
p21M-77	Mini D21S1907-F	*	TCACTCAATTTATGAGAGCGAAA	SEQ ID NO: 91	23	21
p21M-78	Mini D21S1907-R		TCAGCCTTTGATATGTGCATT	SEQ ID NO: 92	21	21
p21M-79	Mini D21S1909-F	*	GCATGAGTGGAAAAATGTGAAA	SEQ ID NO: 93	22	21
p21M-80	Mini D21S1909-R		CTGAGTCAAGAGCAGGCAACT	SEQ ID NO: 94	21	21
p21M-81	Mini D21S1910-F	*	CCAATGCTTTTGATTTTAAGC	SEQ ID NO: 95	22	21
p21M-82	Mini D21S1910-R		CGGCAAAGTAGTATTTAATGTGCT	SEQ ID NO: 96	24	21
P21M-83	Mini D21S1257-F	*	TTTCATTCACCGGTTTTCCT	SEQ ID NO: 97	20	21
p21M-84	Mini D21S1257-R		TTTTAGGGTATATCTGCCATAATGC	SEQ ID NO: 98	25	21
p21M-85	Mini D21S1258-F	*	GGGAAGGAAAATAAAGCATTGA	SEQ ID NO: 99	22	21
p21M-86	Mini D21S1258-R		GCACAAAAACAAAATCTGTCACT	SEQ ID NO: 100	23	21
p21M-87	Mini D21S1913-F	*	TTGCTGGGTTGTTAAACTTATTCA	SEQ ID NO: 101	24	21
p21M-88	Mini D21S1913-R		AAAGGTGAACGCTGGTATCG	SEQ ID NO: 102	20	21
p21M-89	Mini D21S1259-F	*	GACCCCAACACTGGACACA	SEQ ID NO: 103	19	21
p21M-90	Mini D21S1259-R		CTTGGTAAGTGGGCAGTGAG	SEQ ID NO: 104	20	21
p21M-91	Mini D21S1915-F	*	CATGCTCATAGATATGCACACA	SEQ ID NO: 105	22	21
p21M-92	Mini D21S1915-R		GATTGTGCCAGGTCTCAGGT	SEQ ID NO: 106	20	21
p21M-93	Mini D21S1916-F	*	CCAAGGTGAATTCCCAATTT	SEQ ID NO: 107	20	21
p21M-94	Mini D21S1916-R		GCGGCACATTTTCACAGACT	SEQ ID NO: 108	20	21
p21M-95	Mini D21S1917-F	*	TGAACATTAACACTGGTAACTTTACAT	SEQ ID NO: 109	27	21
p21M-96	Mini D21S1917-R		TGTCCTCTCCATTTTGCTTG	SEQ ID NO: 110	20	21
p21M-97	Mini D21S1918-F	*	CTTCTCTCCAATTCCCATGC	SEQ ID NO: 111	20	21
p21M-98	Mini D21S1918-R		GAAGGAAAAATTGGGATTTCG	SEQ ID NO: 112	21	21
p21M-99	Mini D21S1920-F	*	CAGCCTGGGTGACAGAGAC	SEQ ID NO: 113	19	21
p21M-100	Mini D21S1920-R		TGTTGATGAAGCATTTACTCATACAT	SEQ ID NO: 114	26	21
p21M-101	Mini D21S1921-F	*	TCCCCCTAAATGGACAACTTT	SEQ ID NO- 115	21	21
p21M-102	Mini D21S1921-R		GCTTTGTTTTCCTTTAGCTTCC	SEQ ID NO: 116	22	21
p21M-103	Mini D21S1883-F	*	TCTGGAATGGTTAAGGCAGAA	SEQ ID NO: 117	21	21
p21M-104	Mini D21S1883-R		CACCATTCTCCCTAGCATGA	SEQ ID NO: 118	20	21

Number	Name/Loci	5' Label	Sequence	**Seq.** ID No.	Length	Chromosome
P21M-105	Mini D21S1885-F	*	CAAGGTGGAAGGCAGAAGG	SEQ ID NO: 119	19	21
p21M-106	Mini D21S1885-R		CGCGCTCTCTCTCTCTCTCT	SEQ ID NO: 120	20	21
p21M-107	Mini D21S1886-F	*	TGCAAGATTTCCCCCTTCTA	SEQ ID NO: 121	20	21
p21M-108	Mini D21S1886-R		CTTTGACTCCTCAGCCGTGT	SEQ ID NO: 122	20	21
p21M-109	Mini D21S1887-F	*	CCTGGCATCTCTGTTTTTA	SEQ ID NO: 123	19	21
p21M-110	Mini D21S1887-R		AAAGATGATGTCAGGAATGC	SEQ ID NO: 124	20	21
P21M-111	Mini D21S126Q-F	*	CATCCAAGGGGAACACAAGT	SEQ ID NO: 125	20	21
p21M-112	Mini D21S1260-R		GGAAGTAAAAGGCCCAGAGG	SEQ ID NO: 126	20	21
P21M-113	Mini D21S1888-F	*	AAAAAGGATGTTTGTTATGGTAAGA	SEQ ID NO: 127	25	21
p21M-114	Mini D21S1888-R		GAACTGTGTGCCAGGAACTG	SEQ ID NO: 128	20	21
p21M-115	Mini D21S1889-F	*	TGTGTGTTTGCATGTATGTGTAGA	SEQ ID NO: 129	24	21
p21M-116	Mini D21S1889-R		ACAGAAACATGGCTGCCTCT	SEQ ID NO: 130	20	21
p21M-117	Mini D21S1890-F	*	GACCACAGATTTCCCAATCG	SEQ ID NO: 131	20	21
p21M-118	Mini D21S1890-R		AAACCAACTGACTCCCAAACA	SEQ ID NO: 132	21	21
p21M-119	Mini D21S1891-F	*	CAGAGCGAGACTCCATCTCA	SEQ ID NO: 133	20	21
P21M-120	Mini D21S1891-R		GGAACCCTTGGATGTTGCTA	SEQ ID NO: 134	20	21
p21M-121	Mini D21S1894-F	*	GCTCAATGCTATTGGAGTGC	SEQ ID NO: 135	20	21
p21M-122	Mini D21S1894-R		TTCACAAAACAGAACCAACCA	SEQ ID NO: 136	21	21
p21M-123	Mini D21S1895-F	*	TCTCCCTTGCCAGACTTCTC	SEQ ID NO: 137	20	21
p21M-124	Mini D21S1895-R		GCCCAGGATGGACAAAGA	SEQ ID NO: 138	18	21
p21M-125	Mini D21S1896-F	*	CACATGTGGCCACTGCAC	SEQ ID NO: 139	18	21
p21M-126	Mini D21S1896-R		CCAGGGATTTGTCTAGAAAGGA	SEQ ID NO: 140	22	21
p21M-127	Mini D21S1897-F	*	GCCTAGGCAACCAGAGTGAG	SEQ ID NO: 141	20	21
p21M-128	Mini D21S1897-R		TGTATTTCTTTTCTTTTAAATGGTGA	SEQ ID NO: 142	27	21
p21M-129	Mini D21S1898-F	*	CTCTTCAGCAGCCGAGAAAA	SEQ ID NO: 143	20	21
p21M-130	Mini D21S1898-R		CACCAGAAAGCAAGGAAGGA	SEQ ID NO: 144	20	21
p21M-131	Mini D21S1900-F	*	ACACCAGAGGGCAGAGTGAG	SEQ ID NO: 145	20	21
p21M-132	Mini D21S1900-R		AAAGCACTGTATGTTTCTGTGAGA	SEQ ID NO: 146	24	21
p21M-133	Mini D21S1901-F	*	GGTTGTCCAGAGAAACAACCA	SEQ ID NO: 147	21	21
p21M-134	Mini D21S1901-R		CAATTGTGTGAGCCAATCTCTC	SEQ ID NO: 148	22	21
p21M-135	Mini D21S1903-F	*	GGCAATTCCTTAAAATAAATCACTC	SEQ ID NO: 149	25	21
p21M-136	Mini D21S1903-R		GCCCGGCCCTATCTATCTAT	SEQ ID NO: 150	20	21
p21M-137	Mini D21S1905-F	*	GCATGCTCGCTCTCTCTCTT	SEQ ID NO: 151	20	21
p21M-138	Mini D21S1905-R		AACTGGCGTGTCTACACCATC	SEQ ID NO: 152	21	21
p21M-139	Mini D21S1906-F	*	GAGCAAGACTCCATCTCAAAAA	SEQ ID NO: 153	22	21
p21M-140	Mini D21S1906-R		AAAGATTGCCCAACAAATGG	SEQ ID NO: 154	20	21

Number	Name/Loci	s" Label	Sequence	Seq. ID No.	Length	Chromosome
p21M-141	Mini D21S1908-F	*	TGGGTTCCATAGTTCTAATGTGTG	SEQ ID NO: 155	24	21
P21M-142	Mini D21S1908-R		TCTCTGGCTGGACATACTATTCA	SEQ ID NO: 156	23	21
p21M-143	Mini D21S1438-F	*	GGAGAAGGTAGCTAAAGGATGAAA	SEQ ID NO: 157	24	21
p21M-144	Mini D21S1438-R		TGCACCCTAGGACCTAAAGAA	SEQ ID NO: 158	21	21
p21M-145	Mini D21S1439-F	*	CCTGATCTGGTCCTGTAGCC	SEQ ID NO: 159	20	21
p21M-146	Mini D21S1439-R		TGAGTTTGAAAATAAAGTGTTCTGC	SEQ ID NO: 160	25	21
p21M-147	Mini ATA42C09-F	*	CAAAGCGAGACCTTTTCTCAA	SEQ ID NO: 161	21	21
p21M-148	Mini ATA42C09-R		CGAGTCATAGATCCATTACCCATT	SEQ ID NO: 162	24	21
p21M-149	Mini D21S1441-F	*	ACAACCGAGCGAGACCTG	SEQ ID NO: 163	18	21
p21M-150	Mini D21S1441-R		GGAACTGATGGTCACAAGATAGTC	SEQ ID NO: 164	24	21
P21M-151	Mini D21S120-F	*	TTGTGGATTTTCCCAATTGAT	SEQ ID NO: 165	21	21
p21M-152	Mini D21S120-R		TTTGTATTTGCCTAAAAACAGAGC	SEQ ID NO: 166	24	21
p21M-153	Mini D21S167-F	*	TACCAGCTTCAAACGTGCAG	SEQ ID NO: 167	20	21
p21M-154	Mint D21S167-R		CCTTGCCCTGAAGCACAT	SEQ ID NO: 168	18	21
p21M-155	Mini D21S168-F	*	TGTAGGCTGTTTAGTTGGTGGA	SEQ ID NO: 169	22	21
p21M-156	Mini D21S168-R		CGGCATCACAGTCTGATAAAA	SEQ ID NO: 170	21	21
p21M-157	Mini D21S210-F	*	TGATAAGCCTCCCTCACTACTATTTT	SEQ ID NO: 171	26	21
p21M-158	Mini D21S210-R		GCAGCGATAGCTAGTCATAGTGAA	SEQ ID NO: 172	24	21
p21M-159	Mini D21S214-F	*	CCTGCAAGGACACCAAGTTA	SEQ ID NO: 173	20	21
p21M-16Q	Mini D21S214-R		TGTTCACCTGATTTTCGGTTC	SEQ ID NO: 174	21	21
p21M-161	Mini GATA116E08-F	*	TGCAAGCCACATCATTTGT	SEQ ID NO: 175	19	21
P21M-162	Mini GATA116E08-R		TCGAATCGATAGATAGATAGGTGA	SEQ ID NO: 176	24	21
p21M-163	Mini GATA148F04-F	*	TGAAACAAGGGAATCTATCATC	SEQ ID NO: 177	22	21
p21M-164	Mini GATA148F04-R		TGATAAATAGTGAATATAGTTGACAGC	SEQ ID NO: 178	27	21
P21M-165	Mini GATA163G03-F	*	TTGTGGGGCCTTGTAATTGT	SEQ ID NO: 179	20	21
p21M-166	Mini GATA163G03-R		CAGGGTCCCTAGAGAGACAGA	SEQ ID NO: 180	21	21
p21M-167	Mini D21S2055-F	*	CAGAACCAATAGGCTATCTATCT	SEQ ID NO: 181	23	21
p21M-168	Mini D21S2055-R		ACAGTAAATCACTTGGTAGGAGA	SEQ ID NO: 182	23	21
p21M-169	Mini D21S1442-F	*	GGGCACCCCTTTATACTTGG	SEQ ID NO: 183	20	21
p21M-170	Mini D21S1442-R		TCACATGAGCCAATTCCTTATAATAG	SEQ ID NO: 184	26	21
P21M-171	Mini GATA29C02-F	*	TCTATACATATGTGTGTGTGCAT	SEQ ID NO: 185	23	21
p21M-172	Mini GATA29C02-R		CACCTTTGTTGCCAAGAGTC	SEQ ID NO: 186	20	21
p21M-173	Mini GATA29D01-F	*	TTCTGTTAAATGAGTAAGGAGATGACA	SEQ ID NO: 187	27	21
p21M-174	Mini GATA29D01-R		GCATGCGTGTGTGTGTGTAT	SEQ ID NO: 188	20	21
p21M-175	Mini D21S1433-F	*	GAGCTGAGATCACGACAGTCA	SEQ ID NO: 189	21	21
P21M-176	Mini D21S1433-R		TATTTTCAGGCCAAGCCTTT	SEQ ID NO: 190	20	21

Number	Name/Loci	5' Label	Sequence	Seq. ID No.	Length	Chromosome
p21M-177	Mini GATA45C03-F	*	GAAACAGAACTAATAGGATCTATCTGC	SEQ ID NO- 191	27	21
p21M-178	Mini GATA45C03-R		GGCAAACAAATAGTTGATAGATGAG	SEQ ID NO: 192	25	21
p21M-179	Mini D21S1446-F	*	TGACCATCTTACTGGTTTATGTATTT	SEQ ID NO: 193	26	21
p21M-180	Mini D21S1446-R		CGAGGCTATTTTACTGGTAACTAACTG	SEQ ID NO: 194	27	21
p21M-181	Mini D21S1270-F	*	GGGCTACATAGAGAAACAGAACC	SEQ ID NO: 195	23	21
p21M-182	Mini D21S1270-R		ACACACACACACACACATGC	SEQ ID NO- 196	20	21
p21M-183	Mini D21S1436-F	*	GGAAAGAGAAAGAAAGGAAGGAA	SEQ ID NO: 197	23	21
p21M-184	Mini D21S1436-R		CCATTTATGTCCTATTTCCTACTCC	SEQ ID NO: 198	25	21
p21M-185	Mini D21S1265-F	*	GGACTCCTCCAGCTGAACTCT	SEQ ID NO: 199	21	21
p21M-186	Mini D21S1265-R		GCACAGTACAGCAAACTTGTCA	SEQ ID NO: 200	22	21
p21M-187	Mini D21S1249-F	*	TTTCCACACGGCTAATCTACTT	SEQ ID NO: 201	22	21
p21M-188	Mini D21S1249-R		TACCTCCCTCCCTCCATCC	SEQ ID NO: 202	19	21
p21M-189	Mini D21S1409-F	*	GGGGAATACATTTGTGTAGGTAGG	SEQ ID NO: 203	24	21
p21M-190	Mini D21S1409-R		CACTAATACCTGGTGAATGATTCTT	SEQ ID NO: 204	25	21
p21M-191	Mini D21S1410-F	*	AAATGAAGATATTTTCTTAGCTTAT	SEQ ID NO: 205	25	21
p21M-192	Mini D21S1410-R		GCATTCAATATTTTACTTTTAAGAATC	SEQ ID NO: 206	27	21
p21M-193	Mini D21S125Q-F	*	GGGTAAAGAAAATGTGCTCTCTC	SEQ ID NO: 207	23	21
p21M-194	Mini D21S1250-R		GGTTCTCCAAGTTCAATGGTG	SEQ ID NO: 208	21	21
p21M-195	Mini D21S1251-F	*	CAGCAGAAAGGGAATAGTTGG	SEQ ID NO: 209	21	21
p21M-196	Mini D21S1251-R		CAAGTTAAAAACACAAAATGGAAA	SEQ ID NO: 210	24	21
p21M-197	Mini D21S1411-F	*	TGGATGGATGGATAGATACACAG	SEQ ID NO: 211	23	21
p21M-198	Mini D21S1411-R		CCCACTCCCAGCCTTCTAA	SEQ ID NO: 212	19	21
p21M-199	Mini D21S1238-F	*	TCTCTGTGTCTATGTGTGCATGTT	SEQ ID NO. 213	24	21
p21M-200	Mini D21S1238-R		GGTTTTGCAAAGGCAGGTTA	SEQ ID NO: 214	20	21
p21M-201	Mini D21S1239-F	*	CACTTTCACAATATGTATTGCTTATCA	SEQ ID NO: 215	27	21
p21M-202	Mini D21S1239-R		GGTAGCAATTTCACTCTCTCTTTC	SEQ ID NO: 216	24	21
p21M-203	Mini D21S1408-F	*	GATGACAAGACAGATTAGATAGATTGG	SEQ ID NO: 217	27	21
p21M-204	Mini D21S1408-R		CATTGGGCTTAI ¯ТТТТСТТТСТАТ	SEQ ID NO- 218	24	21
p21M-205	Mini UT556-F	*	AAAGGCAGGAAGGCAGGA	SEQ ID NO: 219	18	21
p21M-206	Mini UT556-R		TTTTCTTC ТТТТТТGCTTCTCTTTTC	SEQ ID NO: 220	25	21
p21M-207	Mini D21S1240-F	*	TGATGTAGTTCACTAGGATGTAGGG	SEQ ID NO: 221	25	21
p21M-208	Mini D21S1240-R		CCTGAGACACAAGAGCGAGA	SEQ ID NO: 222	20	21
p21M-209	Mini D21S1412-F	*	CCTGGGTGACAAGAGTGAAA	SEQ ID NO: 223	20	21
p21M-210	Mini D21S1412-R		CACAGAAATTTGTAGAACCACAGC	SEQ ID NO: 224	24	21
p21M-211	Mini D21S1280-F	*	GGCATCAAAATTTGGAAGAAA	SEQ ID NO: 225	21	21
P21M-212	Mini D21S1280-R		AAAGCTGAGCTGAATGGTGA	SEQ ID NO: 226	20	21

Number	Name/Loci	5* Label	Sequence	Seq. ID No.	Length	Chromosome
p21M-213	Mini D21S1413-F	*	GGGAAACCACAGTTATACATTCC	SEQ ID NO: 227	23	21
p21M-214	Mini D21S1413-R		TGTTTACAGTTCTTCACAGAGTTCTT	SEQ ID NO: 228	**26**	21
p21M-215	Mini D21S1244-F	*	ACCACAGAATTCAGTCCAAAAA	SEQ ID NO: 229	22	**21**
p21M-216	Mim D21S1244-R		TTATCCCCTGGAGGAACTTG	SEQ ID NO: 230	**20**	21
P21M-217	Mini D21S1245-F	*	CCAGAAAATGACACATGAAGGA	SEQ ID NO: 231	22	21
p21M-218 i	Mini D21S1245-R		GAGATATTGGCCTGTAGTTTTCT TTT	SEQ ID NO: 232	**26**	21
p21M-219	Mini D21S1414-F	*	GATGTTGTATTAGTCAATGTTCTCCA	SEQ ID NO: 233	**26**	**21**
p21M-220	Mini D21S1414-R		TCTGTCTGTCTGTCTGTCTGTCTG	SEQ ID NO: 234	**24**	21
p21M-221	Mini D21S1246-F	*	ATGGGCAAACAGATGGGTAG	SEQ ID NO: 235	**20**	21
P21M-222	Mini D21S1246-R		CCATATTATCATCCATCCATCCA	SEQ ID NO: 236	**23**	21

Table 3: Mini-STR Primers for Chromosome 13

*Note * 6-hAM, VIC, NED, JOE, ROX, PET, TAMRA or S-FAM*

Number	Name/Loci	5' Label	Sequence	Seq. ID No.	Length	Chromosome
p13M-1	Mini D13S1236-F	*	GGGTMCAGCATAAGACCCTGT	SEQ ID NO: 237	22	13
p13M-2	Mini D13S1236-R		TCACTTTGGTGCTTGCTTTG	SEQ ID NO: 238	20	13
p13M-3	Mini D13S175-F	*	GAATCTGCTGAGAGAGTAGATTTTAAG	SEQ ID NO: 239	27	13
p13M-4	Mini D13S175-R		TGCATCACCTCACATAGGTTACT	SEQ ID NO: 240	23	13
p13M-5	Mini D13S1243-F	*	TGCTGACAGGCTACAGAACTTT	SEQ ID NO: 241	22	13
p13M-6	Mini D13S1243-R		TCTGCATTTGTAGAAATAATCTTATCA	SEQ ID NO: 242	27	13
p13M-7	Mim D13S1304-F	*	ACCATTATTCTCCTGAGTCCTCTC	SEQ ID NO: 243	24	13
p13M-8	Mini D13S1304-R		ACATTCTAGTGCTACAGGGTATTC	SEQ ID NO: 244	24	13
p13M-9	Mini D13S289-F	*	GTCCCACTATCTCAATAATCTGATG	SEQ ID NO: 245	25	13
p13M-10	Mini D13S289-R		ACTGGTCACCTTCATCACCA	SEQ ID NO: 246	20	13
p13M-11	Mini D13S171-F	*	GGAGAAAGGGGAGGTGTAGA	SEQ ID NO: 247	20	13
p13M-12	Mini D13S171-R		CCATCCTCCTCCCTTCTT ΠT	SEQ ID NO: 248	21	13
p13M-13	Mini D13S219-F	*	TTGCCATGTCAATTGCTACA	SEQ ID NO: 249	20	13
p13M-14	Mini D13S219-R		TGTTTCTTGACTTAACATTTTCTTCT	SEQ ID NO: 250	26	13
p13M-15	Mini D13S218-F	*	GATTTGAAAATGAGCAGTCCA	SEQ ID NO: 251	21	13
p13M-16	Mini D13S218-R		GCATGTTTCAGGTCTTTTATTGC	SEQ ID NO: 252	23	13
p13M-17	Mini D13S263-F	*	GCCTGTTAGTTTTTATTGTTATCTTAG	SEQ ID NO: 253	27	13
p13M-18	Mini D13S263-R		TTTTTATCAGAAGCATGAAAACAG	SEQ ID NO: 254	24	13
p13M-19	Mini D13S153-F	*	CTGTTTCTCCTCCCTGCAAC	SEQ ID NO: 255	20	13
p13M-20	Mini D13S153-R		GGAGCGTATCTGTGCGTGTA	SEQ ID NO: 256	20	13
p13M-21	Mini D13S1320-F	*	CACTTCTAGGTTTTTACCCAAGTGA	SEQ ID NO: 257	25	13
p13M-22	Mini D13S1320-R		TGAAGTAACTCTGAACACTCAATACTT	SEQ ID NO: 258	27	13
p13M-23	Mini D13S1296-F	*	GTTTAACCAGGAGCCCTTCC	SEQ ID NO: 259	20	13
p13M-24	Mini D13S1296-R		GAGCAACTACCTACTATGGTTCCTT	SEQ ID NO: 260	25	13
p13M-25	Mini D13S156-F	*	ACTCCAGCCTGGGCGATAG	SEQ ID NO: 261	19	13
p13M-26	Mini D13S156-R		CTTGGATTTATGTATCTCTCCTAGAGT	SEQ ID NO: 262	27	13
p13M-27	Mini D13S1306-F	*	GCTGTTCTTCTAAGTGCCACA	SEQ ID NO: 263	21	13

Number	Name/Loci	5' Label	Sequence	Seq. ID No.	Length	Chromosome
p13M-28	Mini D13S1306-R		GGGGTTGTTGCGAAGATTAG	SEQ ID NO: 264	20	13
p13M-29	Mini D13S170-F	*	TGGAGATAAACACATAGGCACA	SEQ ID NO: 265	22	13
p13M-30	Mini D13S170-R		TAAGGCAGGAGTCATGTCCA	SEQ ID NO: 266	20	13
p13M-31	Mini D13S265-F	*	GCCAATTACATTGCATATTGCAT	SEQ ID NO: 267	23	13
p13M-32	Mini D13S265-R		CAACAAAGCAATAAAGAGTTTTGC	SEQ ID NO: 268	24	13
p13M-33	Mini D13S1241-F	*	ATGGAGTGCCACTGGAAGAA	SEQ ID NO: 269	20	13
p13M-34	Mini D13S1241-R		CCAGTTGAGTTTGGACCTCAG	SEQ ID NO: 270	21	13
p13M-35	Mini D13S159-F	*	GGCCAAAATTAGCGTGACA	SEQ ID NO: 271	19	13
p13M-36	Mini D13S159-R		CAACTCCAGGCCAAATCATC	SEQ ID NO: 272	20	13
p13M-37	Mini D13S158-F	*	CGGAGTGAAAGAAGATTGATTT	SEQ ID NO: 273	22	13
p13M-38	Mini D13S158-R		TTGACAATTTAGCAGCATGTATTT	SEQ ID NO: 274	24	13
p13M-39	Mini D13S173-F	*	AGCCTCATGCCTGGGGATA	SEQ ID NO: 275	19	13
p13M-40	Mini D13S173-R		ATTTTCTTCATTTGGTGTTATTTTGG	SEQ ID NO: 276	26	13
p13M-41	Mini D13S1265-F	*	CTTTTCAGATTAAATGAGACAATATG	SEQ ID NO: 277	26	13
p13M-42	Mini D13S1265-R		TGCTAATGTGTGATTATATGTACGC	SEQ ID NO: 278	25	13

Table 4: Mini-STR Primers for Chromosome 18

*Note * 6-FAM, VIC, NED, JOE, ROX, PET, TAMRA or 5-FAM*

Number	Name/Loci	5" Label	Sequence	Seq. ID No.	Length	Chromosome
p18M-1	Mini D18S51-F	*	TGAGTGACAAATTGAGACCTT	SEQ ID NO: 279	21	18
p18M-2	Mini D18S51-R		GTCTTACAATAACAGTTGCTACTATT	SEQ ID NO: 280	26	18
p18M-3	Mini D18S59-F	*	AACAGGGGCACAAGACAGAT	SEQ ID NO: 281	20	18
p18M-4	Mini D18S59-R		CCCACTCCTGTGCACTCTCT	SEQ ID NO: 282	20	18
p18M-5	Mini D18S476-F	*	GTTGACAATAGCACACATACAGTCC	SEQ ID NO: 283	25	18
p18M-6	Mini D18S476-R		ACCACCACCCACACCATC	SEQ ID NO: 284	18	18
p18M-7	Mini D18S63-F	*	TCTTCCATTCCCATCATTTCA	SEQ ID NO: 285	21	18
p18M-8	Mini D18S63-R		TCTCCAGGAACATTGTTTTACTTT	SEQ ID NO: 286	24	18
p18M-9	Mini D18S1132-F	*	CAGCCTTTTCCAAATTTTACATC	SEQ ID NO: 287	23	18
p18M-10	Mini D18S1132-R		TGCCCTACCAGACCMTTTT	SEQ ID NO: 288	20	18
p18M-11	Mini D18S452-F	*	TGGGGCATACATAGTGCAAA	SEQ ID NO: 289	20	18

Number	Name/Loci	S[1] Label	Sequence	Seq. ID No.	Length	Chromosome
P18M-12	Mini D18S452-R		AAATAACCGCTGGCTCTGTG	SEQ ID NO: 290	20	18
p18M-13	Mini D18S464-F	*	GACTTTGTGCCATTTCTCCA	SEQ ID NO: 291	20	18
p18M-14	Mini D18S464-R		AATCTTCAGGCTGCTTGCAC	SEQ ID NO: 292	20	18
p18M-15	Mini D18S1150-F	*	GGCACAGGAAACGTGAATTT	SEQ ID NO: 293	20	18
P18M-16	Mini D18S1150-R		GCTGTTTTCTTCTGTTGTCTGG	SEQ ID NO: 294	22	18
p18M-17	Mini D18S53-F	*	TTTGGATGTCTTTCTTTCTTCTATCA	SEQ ID NO: 295	26	18
p18M-18	Mini D18S53-R		CAGTGGAAACCAAACTACAACG	SEQ ID NO; 296	22	18
p18M-19	Mini D18S453-F	*	CAATAAAGACCTGACTTGGAAAAA	SEQ ID NO: 297	24	18
p18M-20	Mini D18S453-R		CTCAACACAGCAACAAAAATATAAA	SEQ ID NO: 298	25	18
P18M-21	Mini D18S478-F	*	AAGAGAAGAACATCACTAAGAACCA	SEQ ID NO: 299	25	18
p18M-22	Mini D18S478-R		AACTCAGTGTTCCACAGTAACTCA	SEQ ID NO: 300	24	18
p18M-23	Mini D18S56-F	*	CTGAAGGACCTGCCTGAGAT	SEQ ID NO: 301	20	18
p18M-24	Mini D18S56-R		TACI TTTTIATTGTTAGGGTGTGCTC	SEQ ID NO: 302	25	18
p18M-25	Mini D18S468-F	*	CCCCTGCATAAACTCACTCA	SEQ ID NO: 303	20	18
P18M-26	Mini D18S468-R		TTCCAAAGGACATAATCCATATTT	SEQ ID NO: 304	24	18
p18M-27	Mini D18S450-F	*	GGACCTAGGTTCCAATTTCTCC	SEQ ID NO: 305	22	18
p18M-28	Mini D18S450-R		TGTATGGTGCATGAACCTGTG	SEQ ID NO: 306	21	18
P18M-29	Mini D18S474-F	*	CTGGCCTCCACCCACTAGAT	SEQ ID NO: 307	20	18
p18M-30	Mini D18S474-R		CTTTCAATGTCAGAAGGCATTT	SEQ ID NO: 308	22	18
p18M-31	Mini D18S1127-F	*	ACCCTGGAGAGTGACTGCAT	SEQ ID NO: 309	20	18
p18M-32	Mini D18S1127-R		CGCCTGTACTGCCTGAGTTT	SEQ ID NO: 310	20	18
p18M-33	Mini D18S1129-F	*	GGCTGCACAGGCATTC	SEQ ID NO: 311	16	18
p18M-34	Mini D18S1129-R		GGGAATGCAGTGAAATGGAC	SEQ ID NO: 312	20	18
p18M-35	Mini D18S64-F	*	TTTTGCCACAAAAATTACCAA	SEQ ID NO: 313	21	18
p18M-36	Mini D18S64-R		AAATCAGGAAATCGGCACTG	SEQ ID NO: 314	20	18
p18M-37	Mini D18S1147-F	*	TCAGCACAATGCTACTGGGTA	SEQ ID NO: 315	21	18
p18M-38	Mini D18S1147-R		GACTGGGAACATGGCTCTTC	SEQ ID NO: 316	20	18
p18M-39	Mini D18S68-F	*	TGTGGAAAGTTGTAGATAGGATGAA	SEQ ID NO: 317	25	18
p18M-4Q	Mini D18S68-R		TGAGGATCACACTTTGAGTAGTAAGTC	SEQ ID NO: 318	27	18
p18M-41	Mini D18S61-F	*	CCAAACTACATTCTTCTTCCTGA	SEQ ID NO: 319	23	18
p18M-42	Mini D18S61-R		GAGGAATTTATGCTAAGATTTGAAGG	SEQ ID NO: 320	26	18
p18M-43	Mini D18S469-F	*	AACACGCTTGTCAAATGCTT	SEQ ID NO: 321	20	**18**

Number	Name/Loci	S' Label	Sequence	Seq. ID No.	Length	Chromosome
p18M-44	Mini D18S469-R		TTAAGTTATTGTTGTTGTTTCTTGTGG	SEQ ID NO: 322	27	18
p18M-45	Mini D18S462-F	*	CAGAAGCAGATTTGAACATTGG	SEQ ID NO: 323	22	18
p18M-46	Mini D18S462-R		GCTATAAACATTCACCGTTAGGG	SEQ ID NO: 324	23	18
p18M-47	Mini D18S70-F	*	GGCCTCTCTCCCAGAAAGAT	SEQ ID NO: 325	20	18
p18M-48	Mini D18S70-R		TGTCAAGAAGTACCTACCATATTTTGA	SEQ ID NO: 326	**27**	18

Table 5: Mini-STR Primers for Chromosome X

*Note * 6-1'AM, VIC, NED, JOE, ROX, PEl] TAMRA or 5-hAM*

Number	Name/Loci	5" Label	Sequence	Seq. ID No.	Length	Chromosome
pXM-1	Mini DXS1060-F	*	CTCCCTCTTAATGTTGCCTGT	SEQ ID NO: 327	21	X
pXM-2	Mini DXS1060-R		TGAGAGTCTTTGGTGGGAGA	SEQ ID NO: 328	20	X
pXM-3	Mini DXS1223-F	*	TGCTTTTGGTGTCTTCAATCTG	SEQ ID NO: 329	22	X
pXM-4	Mini DXS1223-R		TGGTCATGTAACAGTGCTTGG	SEQ ID NO: 330	21	X
pXM-5	Mini DXS8051-F	*	TGACATTTAATCAACCAAGAAAT	SEQ ID NO: 331	23	X
pXM-6	Mini DXS8051-R		TTTTTGAACTAAGAACCTGGAG	SEQ ID NO: 332	22	X
pXM-7	Mini DXS7108-F	*	TTGTTAGTGTTTGCAAAGTGATGA	SEQ ID NO: 333	24	X
pXM-8	Mini DXS7108-R		GGATTTATAGATATGGGAGGGTTC	SEQ ID NO: 334	24	X
pXM-9	Mini DXS1224-F	*	CCCTTGATGTAGGCACAGG	SEQ ID NO: 335	19	X
pXM-10	Mini DXS1224-R		CGTGGGGGAGTAGTAGTGGT	SEQ ID NO: 336	20	X
pXM-1 1	Mini DXS8019-F	*	CTTCTTGCATTCCCCATGC	SEQ ID NO: 337	19	X
pXM-12	Mini DXS8019-R		TTTCCTCACAGCAAMGAGG	SEQ ID NO: 338	20	X
pXM-13	Mini DXS7593-F	*	CCTGGGCAACAAGAGTGAA	SEQ ID NO: 339	19	X
pXM-14	Mini DXS7593-R		GGAAAGAGAGTTATATTTAAGAGCAGA	SEQ ID NO: 340	27	X
pXM-1 5	Mini DXS1226-F	*	CCCATCTGTCCTCCTGGATA	SEQ ID NO. 341	20	X
pXM-16	Mini DXS1226-R		GGTCCCCTATTTGTCTTGTCC	SEQ ID NO: 342	21	X
pXM-17	Mini DXS1061-F	*	TCCCTTTCTCTCTCTCTCTCTC	SEQ ID NO: 343	24	X
pXM-18	Mini DXS1061-R		TGATGTGTTATGAATTGGCAAAA	SEQ ID NO: 344	23	X
pXM-19	Mini DXS1214-F	*	GGTTGGAATGACTGAAGGCTTA	SEQ ID NO: 345	22	X
pXM-20	Mini DXS1214-R		AAGATAGCAGGCAACAATAAGAT	SEQ ID NO: 346	23	X
pXM-21	Mini DXS1068-F	*	GGTTCTAGGGACACTCCCTTC	SEQ ID NO: 347	21	X

Number	Name/Loci	5' Label	Sequence	Seq. ID No.	Length	Chromosome
pXM-22	Mini DXS1 068-R		AGACCATGGCCTGCTTTTA	SEQ ID NO: 348	19	X
pXM-23	Mini DXS801 5-F	*	GCCTTACACACAAGCACACC	SEQ ID NO: 349	20	X
pXM-24	Mini DXS801 5-R		GCACCAATATCAAAGCAGCA	SEQ ID NO: 350	20	X
pXM-25	Mini DXS993-F	*	ACCACTCAGCCAGTTTGCTT	SEQ ID NO: 351	20	X
pXM-26	Mini DXS993-R		GAACTGGCCTTGCCTTCAC	SEQ ID NO: 352	19	X
pXM-27	Mini DXS8080-F	*	GGGCAACAAGAGCAAAACTC	SEQ ID NO: 353	20	X
pXM-28	Mini DXS8080-R		CCCTGTTGGTAAATCCTTGG	SEQ ID NO: 354	20	X
pXM-29	Mini DXS8083-F	*	CAAGGAACTCAAACAACAGTTTACA	SEQ ID NO: 355	25	X
pXM-30	Mini DXS8083-R		TCTTTGCCCACTTTTTAATGG	SEQ ID NO: 356	21	X
pXM-31	Mini DXS991-F	*	GGTTCTCCAGAGGGACAGAA	SEQ ID NO: 357	20	X
pXM-32	Mini DXS991-R		TCTCCCTGATAAACTCCTTTTCAT	SEQ ID NO: 358	24	X
pXM-33	Mini DXS1 216-F	*	TCTCTTTCAGTGACCCCTCCT	SEQ ID NO: 359	21	X
pXM-34	Mini DXS1 216-R		GGGGAAAGAGAGAGAGAGGAA	SEQ ID NO: 360	21	X
pXM-35	Mini DXS986-F	*	CCACAAGCAGATAAAGAAAATGTG	SEQ ID NO: 361	24	X
pXM-36	Mini DXS986-R		TCATTTTTATGGCCATGGTATGT	SEQ ID NO: 362	23	X
pXM-37	Mini DXS1 196-F	*	TATTTCCCCCAGCACCCTTT	SEQ ID NO: 363	20	X
pXM-38	Mini DXS1 196-R		TTTCAGTAAAATCATACACCTTTAACA	SEQ ID NO: 364	27	X
pXM-39	Mini DXS1 217-F	*	ATCTTTGGAGGGGAAGGAGT	SEQ ID NO: 365	**20**	X
pXM-40	Mini DXS1 217-R		GAAGTATCGTATCTGAATCCCGTA	SEQ ID NO: 366	24	X
pXM-41	Mini DXS8020-F	*	TTCAAAGAGCCCTCTGCTGT	SEQ ID NO: 367	20	X
pXM-42	Mini DXS8020-R		ACAATTCTGTATAGACTTTGTGTGT	SEQ ID NO: 368	25	X
pXM-43	Mini DXS1 106-F	*	TGAGAACTCCCTAAACAAAATGT	SEQ ID NO: 369	23	X
pXM-44	Mini DXS1 106-R		TTCCTTGAATGTAAGGATTAGGG	SEQ ID NO: 370	**23**	X
pXM-45	Mini DXS1 059-F	*	TTTGCCTACCACGGTTGTCT	SEQ ID NO: 371	20	X
pXM-46	Mini DXS1 059-R		ACCCGTCGTGGTTGTGAT	SEQ ID NO: 372	18	X
pXM-47	Mini DXS8088-F	*	TCCTGTTTTCCAGTACCAGAAGT	SEQ ID NO: 373	23	X
pXM-48	Mini DXS8088-R		GAGTCTATTAGGAGCACAAAAAGG	SEQ ID NO: 374	24	X
pXM-49	Mini DXS8055-F	*	TTGACTAGAAATGCTCCCTCAA	SEQ ID NO: 375	22	X
pXM-50	Mini DXS8055-R		CAGGTTTCTGTGTGGACATTG	SEQ ID NO: 376	21	X
pXM-51	Mini DXS8064-F	*	ACTCCAGCCTGAGCAACAG	SEQ ID NO: 377	19	X
pXM-52	Mini DXS8064-R		CATTGCTCCCCCAACAACT	SEQ ID NO: 378	19	X
pXM-53	Mini DXS8067-F	*	GAGGGCAACAGAGTGGAGAC	SEQ ID NO: 379	**20**	X

Number	Name/Loci	S' Label	Sequence	Seq. ID No.	Length	Chromosome
pXM-54	Mini DXS8067-R		TGATTTTGTACACATTTATGGGGTAT	SEQ ID NO: 380	26	X
pXM-55	Mini DXS1 0Q1-F	*	CCTTCACATGTATCCCCAAA	SEQ ID NO: 381	20	X
pXM-56	Mini DXS1 001-R		TGAATGGATAAAGAAAATGTGGT	SEQ ID NO: 382	23	X
pXM-57	Mini DXS8009-F	*	AAACTGTGGAAATTGCTTCCAT	SEQ ID NO: 383	22	X
pXM-58	Mini DXS8009-R		TCAACAAATTCCAGGTTATGTCA	SEQ ID NO: 384	23	X
pXM-59	Mini DXS1 047-F	*	TTTTAAAAACTTCTACAATGAGCA	SEQ ID NO: 385	24	X
pXM-60	Mini DXS1 047-R		CCTAGGTAACATAGTGAGACCTTGTC	SEQ ID NO: 386	26	X
pXM-61	Mini DXS1 062-F	*	ATGATGCCTGGCACACAGTA	SEQ ID NO: 387	20	X
pXM-62	Mini DXS1 062-R		AAGCACTTTGAATCATTTACGG	SEQ ID NO: 388	22	X
pXM-63	Mini DXS984-F	*	ACCCCCACCTCCCTGAAATA	SEQ ID NO: 389	20	X
pXM-64	Mini DXS984-R		TGCCCTACTCCATTCCACAC	SEQ ID NO: 390	20	X
pXM-65	Mini DXS1 205-F	*	CCACTTGTCCTCTTGCTACACA	SEQ ID NO: 391	22	X
pXM-66	Mini DXS1205-R		TGGCTTAGAGTAC TTTTTTCACTGC	SEQ ID NO: 392	24	X
pXM-67	Mini DXS1227-F	*	TCCAAAATAACACTGAAACACG	SEQ ID NO: 393	22	X
pXM-68	Mini DXS1227-R		AAGGGTTTACTCCCCCAAAA	SEQ ID NO: 394	20	X
pXM-69	Mini DXS81 06-F	*	GGTATAAAACTGAACTCATCAGCA	SEQ ID NO: 395	24	X
pXM-70	Mini DXS8106-R		AGCTGTAGAGTTGAGGAATGTTTTC	SEQ ID NO: 396	25	X
pXM-71	Mini DXS8043-F	*	AAACATTTGGTTAGGCTAATTTCTAT	SEQ ID NO: 397	26	X
pXM-72	Mini DXS8043-R		AAACAAATGCGAATTTAAAAAGA	SEQ ID NO: 398	23	X
pXM-73	Mini DXS8045-F	*	GGAGATTTCTTCCTTGTTGCAC	SEQ ID NO: 399	22	X
pXM-74	Mini DXS8045-R		GCTAGGCTGTGTGTGTCTGTG	SEQ ID NO: 400	21	X
pXM-75	Mini DXS998-F	*	AAAGGCAAAGAAAAACTGTTGC	SEQ ID NO: 401	22	X
pXM-76	Mini DXS998-R		GATCATTCATATAACCTCAAAAGAACT	SEQ ID NO: 402	27	X
pXM-77	Mini DXS8069-F	*	GGCATCGTATTCATTGTTCCA	SEQ ID NO: 403	21	X
pXM-78	Mini DXS8069-R		AGGTTCTTCCAAATTA TTTTTTGTG	SEQ ID NO: 404	24	X
pXM-79	Mini DXS1 073-F	*	TGAAACACTGCTCCCCTTG	SEQ ID NO: 405	19	X
pXM-80	Mini DXS1 073-R		ccGAGTTATTACAAAGAAGCACA	SEQ ID NO: 406	23	X

[0050J Although the invention has been described with reference to the presently preferred embodiment, it should be understood that various modifications can be made without departing from the spirit of the invention. Accordingly, the invention is limited only by the following claims.

CLAIMS

1. A method for conducting a genetic test of a fetus comprising

isolating a nucleic acid sample from a cervical mucus sample obtained from a female subject containing the fetus,

wherein the nucleic acid sample consisting essentially of polynucleotides in a size ranging from about 50 base pairs to about 300 base pairs and

wherein the result of a genetic test on the nucleic acid sample is indicative of a genetic composition of the fetus.

2. The method of claim 1, wherein the cervical mucus sample is obtained by transcervical swabs, endocervical lavage, cytobrush, aspiration, intrauterine lavage, or a combination thereof.

3. The method of claim 1, wherein the nucleic acid sample is isolated by size fractionation.

4. The method of claim 1, wherein the nucleic acid sample is a DNA sample or an RNA sample.

5. The method of claim 1, further comprising using the isolated nucleic acid sample to test for a genetic composition not uniquely associated with Y chromosome, wherein the genetic composition of the isolated nucleic acid sample is indicative of the genetic composition of the fetus.

6. The method of claim 5, wherein the genetic composition is selected from the group consisting of monosomy, partial monosomy, trisomy, partial trisomy, chromosomal translocation, chromosomal duplication, chromosomal deletion, and chromosomal inversion.

7. The method of claim 5, wherein the genetic composition is indicative of a disease condition selected from the group consisting of Down Syndrome, Edwards Syndrome, Patau Syndrome, Fragile X Syndrome, Turner Syndrome, Klinefelter' s Syndrome,

Triple X syndrome, XYY syndrome, Trisomy 8, Trisomy 16, Wolf-Hirschhorn Syndrome, and RhD Syndrome.

8. The method of claim 1, further comprising using the isolated nucleic acid sample as a template for a genetic test using an assay technology selected from the group consisting of PCR, real-time PCR, LCR, Q-B-replicase, SDA, RCA, TMA, LADA, MDA, and invader.

9. The method of claim 1, further comprising using the isolated nucleic acid sample to test the presence of an allele in the fetus, wherein the presence of the allele is based on the amplification of a nucleotide fragment using a pair of primers specific for the allele.

10. The method of claim 9, wherein the allele corresponds to a genetic condition selected from the group consisting of sickle-cell anemia, Phenylketonuria, Tay-Sachs disease, Cystic Fibrosis, beta-Thalassemia, Adrenal Hyperplasia, Fanconi Anemia, Spinal Muscularatrophy, Duchenne's Muscular Dystrophy, Huntington's Disease, Myotonic Dystrophy, Robertsonian translocation, Angelman syndrome, DiGeorge Syndrome, Tuberous Sclerosis, Ataxia Telangieltasia, and Prader-Willi syndrome.

11. The method of claim 1, further comprising using the isolated nucleic acid sample to determine the presence of a genetic marker in the fetus, wherein the determination is based on the amplification of a nucleotide fragment using a pair of primers specific for the genetic marker.

12. The method of claim 9, wherein the pair of primers is selected from the group consisting of primers of SEQ ID NOs: 1 and 2; SEQ ID NOs: 3 and 4; SEQ ID NOs: 5 and 6; SEQ ID NOs: 9 and 10; SEQ ID NOs: 11 and 12; and SEQ ID NOs: 13 and 14.

13. The method of claim 9, wherein the pair of primers is selected from the group consisting of primer sets listed in Tables 2, 3, 4 and 5.

14. The method of claim 11, wherein the pair of primers is selected from the group consisting of primers of SEQ ID NOs: 1 and 2; SEQ ID NOs: 3 and 4; SEQ ID NOs: 5 and 6; SEQ ID NOs: 9 and 10; SEQ ID NOs: 11 and 12; and SEQ ID NOs: 13 and 14.

15. The method of claim 11, wherein the pair of primers is selected from the group consisting of primer sets listed in Tables 2, 3, 4 and 5.

16. A genetic testing kit suitable for testing genetic composition of a fetus comprising a pair of primers suitable for amplifying a desired allele or genetic marker, wherein the amplified nucleotide fragment is less than about 200 base pairs and wherein the desired allele or genetic marker is not uniquely associated with Y chromosome.

17. The genetic testing kit of claim 16, wherein the pair of primers is selected from the group consisting of primers of SEQ ID NOs: 1 and 2; SEQ ID NOs: 3 and 4; SEQ ID NOs: 5 and 6; SEQ ID NOs: 9 and 10; SEQ ID NOs: 11 and 12; and SEQ ID NOs: 13 and 14.

18. The genetic testing kit of claim 16, wherein the pair of primers is selected from the group consisting of primer sets listed in Tables 2, 3, 4 and 5.

19. The genetic testing kit of claim 16, further comprising an instruction for using the pair of primers to test genetic composition of a fetus.

20. The genetic testing kit of claim 16, further comprising an instruction for using the pair of primers to test genetic composition of a fetus on an isolated DNA sample from a cervical mucus sample obtained from a female subject containing the fetus, wherein the DNA sample consisting essentially of polynucleotides in a size ranging from about 50 base pairs to about 200 base pairs.

21. A genetic testing kit suitable for testing genetic composition of a fetus comprising an isolated DNA sample from a cervical mucus sample obtained from a female subject containing the fetus, wherein the DNA sample consisting essentially of polynucleotides in a size ranging from about 50 base pairs to about 200 base pairs.

22. The genetic testing kit of claim 21, further comprising an instruction of using the DNA sample to test the genetic composition of the fetus.

23. The genetic testing kit of claim 21, further comprising an instruction of using the DNA sample to test the genetic composition of the fetus in combination with a pair of primers suitable for amplifying a desired allele or genetic marker, wherein the amplified nucleotide fragment is less than about 200 base pairs.

24. The genetic testing kit of claim 23, wherein the desired allele or genetic marker is not uniquely associated with Y chromosome.

25. An isolated DNA sample useful for genetic testing of a fetus obtained by isolating DNA fragments in a size ranging from about 50 base pairs to about 200 base pairs from a cervical mucus sample obtained from a female subject containing the fetus.

26. The isolated DNA sample of claim 25, wherein the sample is substantially free of non-nucleic acid components.

27. A method of isolating a fetal nucleic acid sample comprising:

isolating a nucleic acid sample consisting essentially of polynucleotides of about 50 base pairs to about 300 base pairs in length from a cervical mucus sample obtained from a female subject containing the fetus.

Size Fractionation of Total DNA from Transport Media on 10 % PAGE

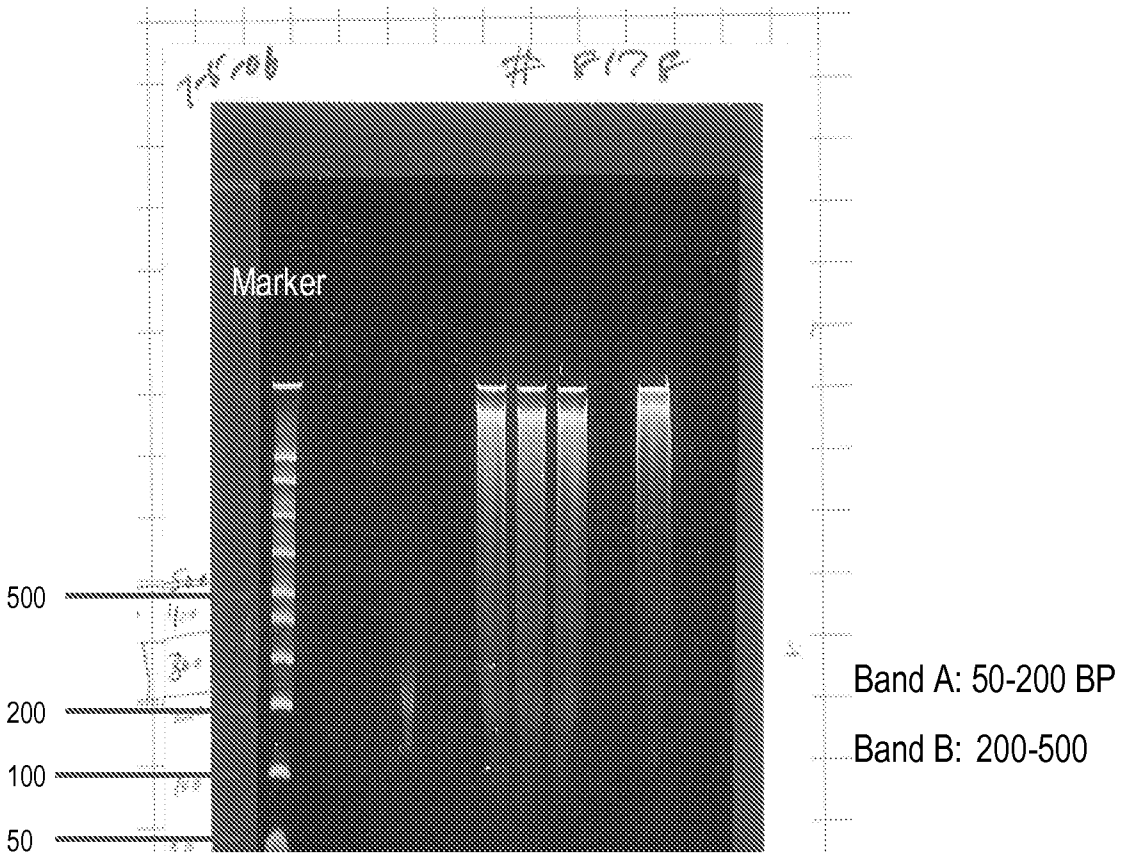

FIGURE 1

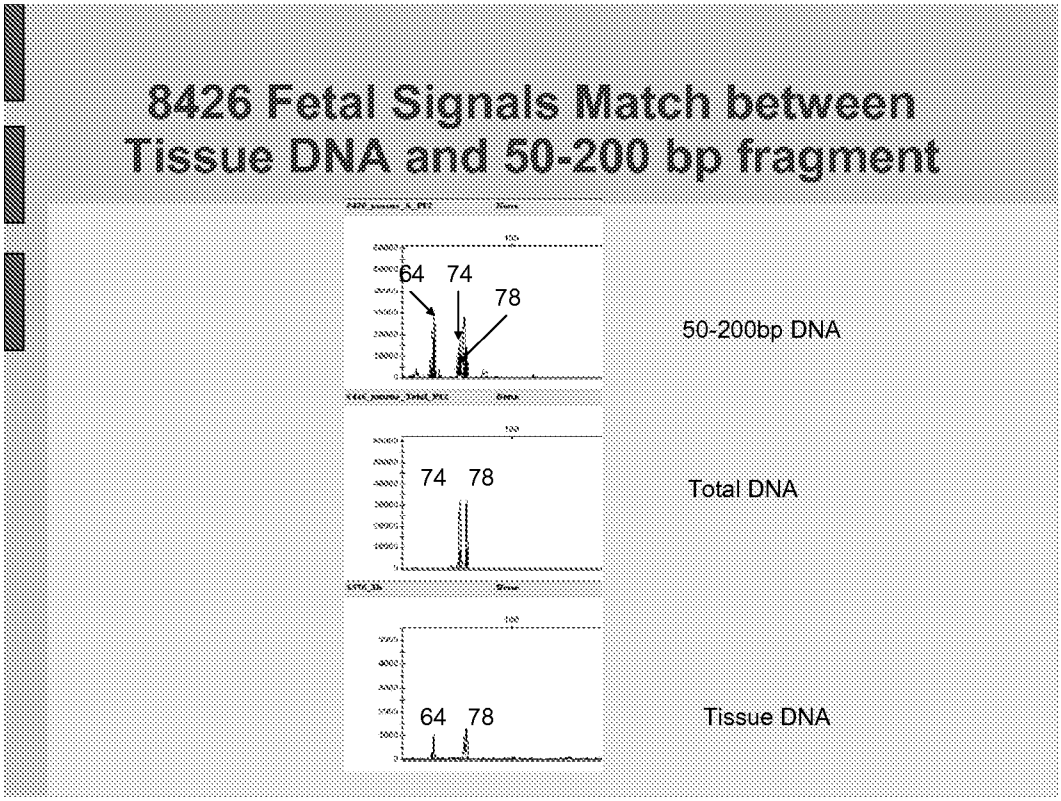
8426 Fetal Signals Match between Tissue DNA and 50-200 bp fragment
64
74
78
50-200bp DNA
74
78
Total DNA
64
78
Tissue DNA

FIGURE 2

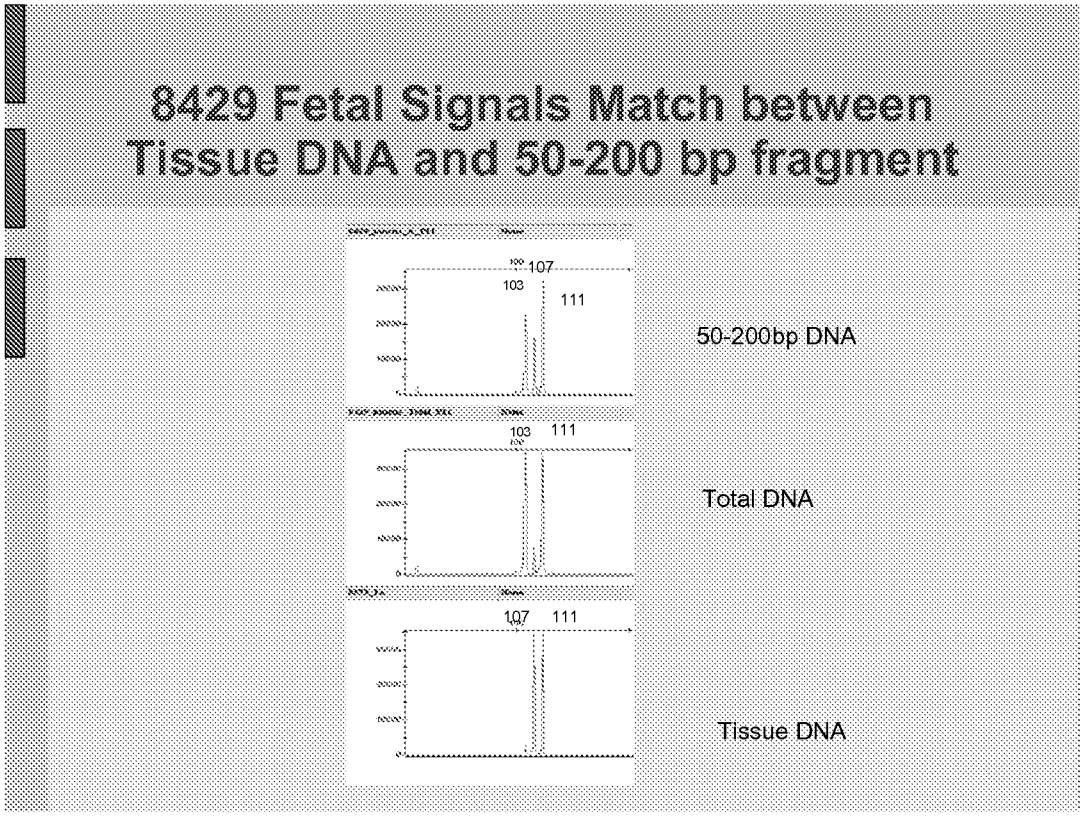
8429 Fetal Signals Match between Tissue DNA and 50-200 bp fragment
107
103
111
50-200bp DNA
103
111
Total DNA
107
111
Tissue DNA

FIGURE 3