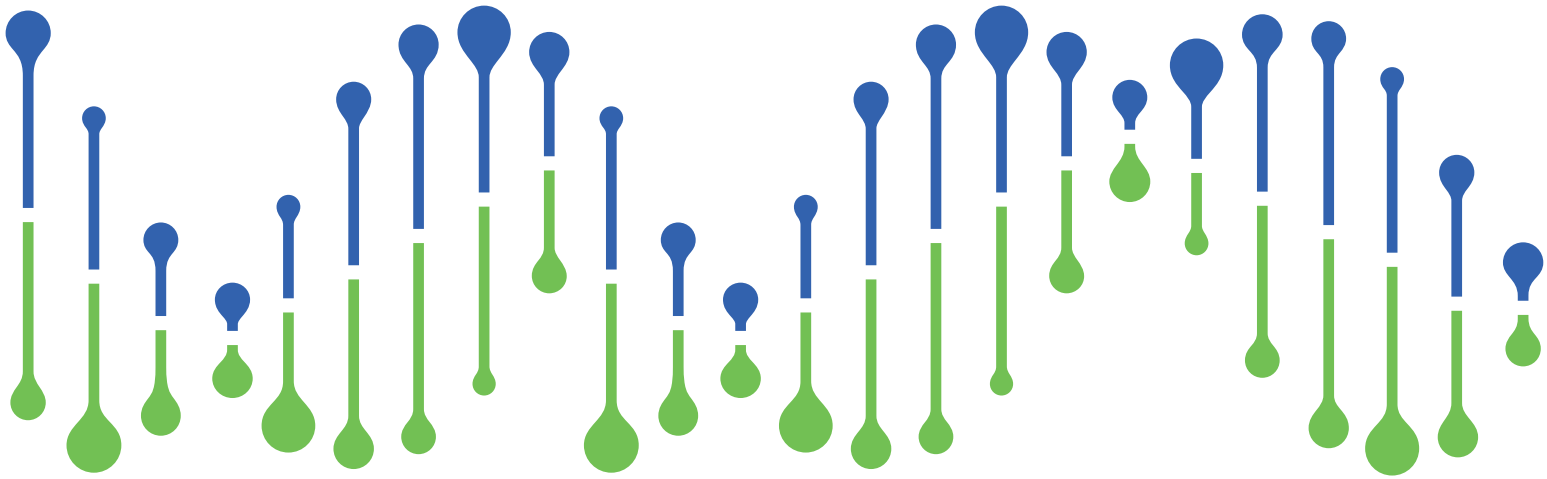
Protocol Guide v1.0.9

Cell3™ Direct

Fetal Sex Determination



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Updates from version 1.0.8

1. In the **Optional qPCR Setup for Extracted Cell-Free DNA** section, wording has been corrected to state that Table 4 should be used to prepare positive, negative and no-template controls when using cfDNA as input material.

Intended use

The intended use of the Cell3™ Direct Fetal Sex Determination kit is for the detection of chromosome Y specific sequences in plasma obtained from pregnant women at 8 or more weeks of gestation. Cell-free DNA is present in the blood of every individual and in pregnant women around 2-20% of cell-free DNA is of fetal origin. In women who are at risk of carrying a child affected by a genetic disorder which manifests only in males or females, a test to determine the sex of the fetus is often conducted early in pregnancy.

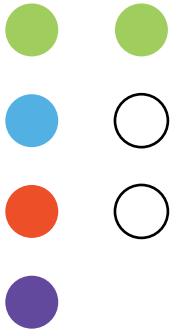
The outcome of such test will instruct on whether further genetic testing is necessary to determine the health of the fetus.

The Cell3™ Direct Fetal Sex Determination kit provides all necessary reagents to conduct fetal sex determination testing by real-time quantitative PCR using plasma as the input material. The assay provides high sensitivity and specificity by targeting multiple Y chromosome-specific sequences. Positive and negative controls are also included in the kit for quality control purposes. Primers and probes are provided plated in a 96 well plate with break-apart columns to allow for testing of single or multiple samples.

Kit contents

Layout of primer and probe multiplexes in a break-apart plate:

	1	2	3	4	5	6	7	8	9	10	11	12
A	ST	ST	ST	ST	ST	ST	ST	ST	ST	ST	ST	ST
B	DC	DC	DC	DC	DC	DC	DC	DC	DC	DC	DC	DC
C	ST	ST	ST	ST	ST	ST	ST	ST	ST	ST	ST	ST
D	DC	DC	DC	DC	DC	DC	DC	DC	DC	DC	DC	DC
E	ST	ST	ST	ST	ST	ST	ST	ST	ST	ST	ST	ST
F	DC	DC	DC	DC	DC	DC	DC	DC	DC	DC	DC	DC
G	ST	ST	ST	ST	ST	ST	ST	ST	ST	ST	ST	ST
H	DC	DC	DC	DC	DC	DC	DC	DC	DC	DC	DC	DC



ST assay = primers / probes targeting the SRY (FAM labelled) and TSPY (HEX labelled) genes

DC assay = primers / probes targeting the DAZ (FAM labelled) and CCR5 (HEX labelled) genes

Enzyme Mix

DFP Buffer

10% Positive control *

Negative control *

Water (PCR)

**Positive and negative genomic DNA controls are at a final concentration of 1 ng per replicate or 300 genomic equivalents. Therefore, within the 10% positive control 30 genomic equivalents are of male origin and 270 of female origin.*

Required equipment

Centrifuge equipped with swinging bucket rotor capable of accommodating 15 ml falcon tubes and 96 well plates

Pipette p100 / p200 /p1000

Class II Biosafety Cabinet or similar

Microcentrifuge (1.5 – 2.0 ml)

Vortexer

96 well plate holder

Real Time (qPCR) machine with minimum of 2 channels (FAM/HEX) or (FAM/VIC)

Additional user supplied consumables

0.5 – 1.5 – 2 ml PCR clean / DNA free micro centrifuge tubes

Pipette filter tips for p100 / p200 / p1000

Disposable sterile laboratory gloves

Storage and handling

All components are shipped at room temperature and are stable in these conditions for transportation. Upon arrival briefly centrifuge all kit components to ensure that content is collected at the bottom of the tube/wells. Store the DFP Buffer solution at +4°C and all other kit components at -20°C. The 96 well plate containing primers and probes and the Enzyme Mix are light sensitive and should be kept in the dark. Before use please ensure all reagents are fully thawed, thoroughly mixed and spun down. The Enzyme Mix is ready to use and contains a concentration of ROX compatible with all qPCR machines. Avoid repeated freezing and thawing.

qPCR machine compatibility

	ABI Life Technologies		Bio-Rad			Bio-Rad MJ Research		Eppendorf	Biometra	Stratagene/ Agilent			Techne
	7000, 7300, 7500, 7700, 7900	7500 Fast	CFX96	iCycler™ IQ, IQ™ 4, IQ™ 5	MyiQ™	Chromo4™	Opticon™, Opticon2™	Mastercycler™ ep realplex	Toptical Thermalcycler	Mx3000P™	Mx3005P™	Mx4000™	Quantica
C3102SP Standard BreakApart Plate	■			■	■			■	■	■	■	■	■
C3101LP Low Profile BreakApart Plate		■	■			■	■	■	■				

If your qPCR machine is not listed above please contact **info@nonacus.com** for further clarification.

Plasma isolation

Please note that blood samples received in EDTA tubes (purple lid) should be stored at +4°C and processed within 24 hours of blood draw. Samples received in Cell-Free DNA BCT Streck tubes should be stored at room temperature and processed within 7 days of blood draw. The sample should not be processed if received in any other tube or if clotted.

All work should be carried out in a Class II biosafety cabinet using standard aseptic techniques to maintain sample sterility.

1. Centrifuge the blood sample at 2,000 g for 10 minutes using a swinging bucket rotor.
2. Collect the separated plasma using a 1,000 µl pipette **ensuring that the buffy coat remains undisturbed.**
3. Aliquot into 1.5 – 2 ml sterile 'PCR Clean' microcentrifuge tubes.
4. Centrifuge at maximum speed (minimum 10,000 g) for 10 minutes in a microcentrifuge.

   NOTE: the second centrifugation step ensures that isolated plasma is free of cell debris, which can reduce qPCR efficiency and result in higher Ct values.
5. Taking care not to disturb the pellet retrieve the supernatant using a 1,000 µl pipette and aliquot into a fresh sterile 'PCR Clean' microcentrifuge 1.5 – 2 ml tube.
6. Plasma can be stored at -20°C for long term storage. The sample is now ready for direct from plasma testing (Direct from Plasma qPCR) or alternatively the sample can be processed following cell free DNA extraction (follow optional qPCR on extracted cell free DNA protocol below).

NOTE: frozen plasma can be thawed at room temperature or in a heat block/bath at 37°C and used for direct from plasma testing or cfDNA extraction. When used for direct from plasma testing, vortex briefly once thawed and spin down at maximum speed in a microcentrifuge for 2 minutes. Direct from plasma testing has been conducted on plasma samples subjected to up to 4 freeze/thaw cycles with no observed negative effect on test performance.

Direct from plasma qPCR

Table 1 outlines the required volumes of sample and reagents needed to set up the direct from plasma qPCR reaction for a total of six replicates per sample (3x ST and 3x DC). Refer to Table 2 to prepare the recommended positive, negative and no template controls. All procedures should be carried out in a sterile environment, ideally a Class II biosafety cabinet.

Table 1. Plasma preparation for 1 sample (includes 7% excess)

Plasma samples	Plasma (µl)	DFP buffer (µl)	Enzyme mix (µl)	Final volume (µl)
x1 sample (6 replicates)	80	80	160	320

Table 2. Control preparation for 1 sample (includes 7% excess)

Controls	Control (µl)	DFP buffer (µl)	Water (µl)	Enzyme mix (µl)	Final volume (µl)
x1 sample (6 replicates)	6.4	80.0	73.6	160	320

1. Add plasma to DFP Buffer (using the volumes indicated in Table 1) in individual sterile 'PCR Clean' 0.5 – 1.5 ml microcentrifuge tube.
2. Vortex for 10 seconds, spin down and incubate at room temperature for 2 minutes.
3. Add control to PCR grade water and DFP Buffer (using the volumes indicated in Table 2) in individual sterile 'PCR Clean' 0.5 – 1.5 ml microcentrifuge tube.
4. Vortex for 5 seconds and spin down.
5. Add the enzyme mix to the tubes containing plasma or controls to prepare the final reaction mix.
6. Vortex for 5 seconds and spin down.
7. From the provided break-apart plate, break away the number of columns required to process the number of samples and recommended controls ensuring that caps are not dislodged. To break apart the plate, place your thumbs on the top of the plate and around each end. Your fingers should meet on the underneath and touch where you wish the plate to break. Now simply fold the plate back on itself until the lids touch and your palms meet. Gently snap the plate at the selected break point. A 96 well plate holder can be used to keep one side of the plate firm while snapping apart the other side.
8. Spin down the plate columns needed containing primers and probes prior to use and carefully remove caps.
9. Aliquot 50 µl of the final reaction mix containing plasma or control to the dedicated wells of the plate or break-apart columns. Please see plate layout above for more details. Ensure the primer and probes in the plate or column are mixed thoroughly with the final reaction mix by pipette mixing 4 – 5 times or vortexing the plate for 5-10 seconds.
10. Carefully seal plate / columns with the provided optically clear 8 well cap strips.

    NOTE: in order to minimize the possibility of cross-well contamination, it is advised to remove one 8 well cap strip at a time (step 8), add the final reaction mix (step 9), and seal the column with the optically clear 8 well cap strip (step 10) before moving on to the next 8 wells in the adjacent column.
11. Spin down the plate by directly placing it in the centrifuge rotor adaptor or if using columns from the break-apart plate first insert them into a 96 well plate holder and spin at 1,000 g for 2 minutes in a plate centrifuge.

qPCR instrument setup and cycling conditions direct from plasma

Set up the qPCR instrument using manufacturers guidelines. Where possible, choose the Quantitation by Comparitive Ct (ΔΔCt) method with TaqMan or "Other" reagents (do not add a melt curve option). For qPCR instruments with "FAST" blocks, select the Standard ramp speed. Select the FAM filter for SRY and DAZ targets; and the HEX or VIC filter for TSPY and CCR5 targets. Where possible, select NFQ-MGB as quencher; or alternatively leave this field empty. Do not select a dye as quencher (such as TAMRA). Select Program cycling conditions as shown in table below. Set reaction volume to 5o µl and select the white well plate setting (when possible).

Cycle step	Temp.	Time	Cycles
Initial activation	98°C	10 min	1
Denaturation	95°C	10 sec	50
Annealing/Elongation	60°C	30 sec	

Optional qPCR setup for extracted cell-free DNA

Cell-free DNA should be extracted from plasma using a recognised and validated kit specific for cell free DNA extraction. Table 3 outlines the required volumes of sample and reagents needed to set up the qPCR reaction for extracted cell-free DNA for a total of six replicates per sample (5x EX and 1x C5). Refer to Table 4 to prepare the recommended positive, negative and no template controls. All procedures should be carried out in a sterile environment, ideally a Class II biosafety cabinet.

Table 3. cfDNA preparation for 1 sample (includes 7% excess)

cfDNA samples	cfDNA (µl)	Water (µl)	Enzyme mix (µl)	Final volume (µl)
x1 sample (6 replicates)	32*	128	160	320

** Based on a cell- free DNA extraction from 1 ml of plasma and final elution volume of 60 µl. Volumes of extracted cell-free DNA and PCR grade water can be adjusted as required up to a combined volume of 160 µl.*

Table 4. Control preparation for 1 sample (includes 7% excess)

Controls	Control (µl)	Water (µl)	Enzyme mix (µl)	Final volume (µl)
x1 sample (6 replicates)	6.4	153.6	160	320

1. Add cell-free DNA and PCR grade water to the Enzyme Mix (using the volumes in the table above) in individual sterile 'PCR Clean' 0.5 – 1.5 ml microcentrifuge tube to prepare the final reaction mix.
2. Vortex for 5 seconds and spin down.
3. Add control and PCR grade water to the Enzyme Mix (using the volumes indicated in Table 4) in individual sterile 'PCR Clean' 0.5 – 1.5 ml microcentrifuge tube.
4. Vortex for 5 seconds and spin down.
5. From the provided break-apart plate, break away the number of columns required to process the number of samples and recommended controls ensuring that caps are not dislodged. To break apart the plate, place your thumbs on the top of the plate and around each end. Your fingers should meet on the underneath and touch where you wish the plate to break. Now simply fold the plate back on itself until the lids touch and your palms meet. Gently snap the plate at the selected break point. A 96 well plate holder can be used to keep one side of the plate firm while snapping apart the other side.
6. Spin down the plate or columns needed containing primers and probes prior to use and carefully remove caps.
7. Aliquot 50 µl of the final reaction mix containing cell free DNA / control to the dedicated wells of the plate or break-apart columns. Please see plate layout above for more details. Ensure the primer and probes in the plate or column are mixed thoroughly with the final reaction mix by pipette mixing 4 – 5 times or vortexing the plate for 5-10 seconds.
8. Carefully seal plate / columns with the provided optically clear 8 well cap strips.

   NOTE: in order to minimize the possibility of cross-well contamination, it is advised to remove one 8 well cap strip at a time (step 6), add the final reaction mix (step 7), and seal the column with the optically clear 8 well cap strip (step 8) before moving on to the next 8 wells in the adjacent column.
9. Spin down the plate by directly placing in the centrifuge rotor adaptor or if using columns from the break apart plate first insert tem into a 96 well plate holder and spin at 1,000 g for 2 minutes in a plate centrifuge.

qPCR instrument setup and cycling conditions for extracted cell free DNA

Set up the qPCR instrument using manufacturers guidelines and as indicated in the qPCR instrument setup and cycling conditions for direct from plasma protocol above. Program cycling conditions as shown in table below.

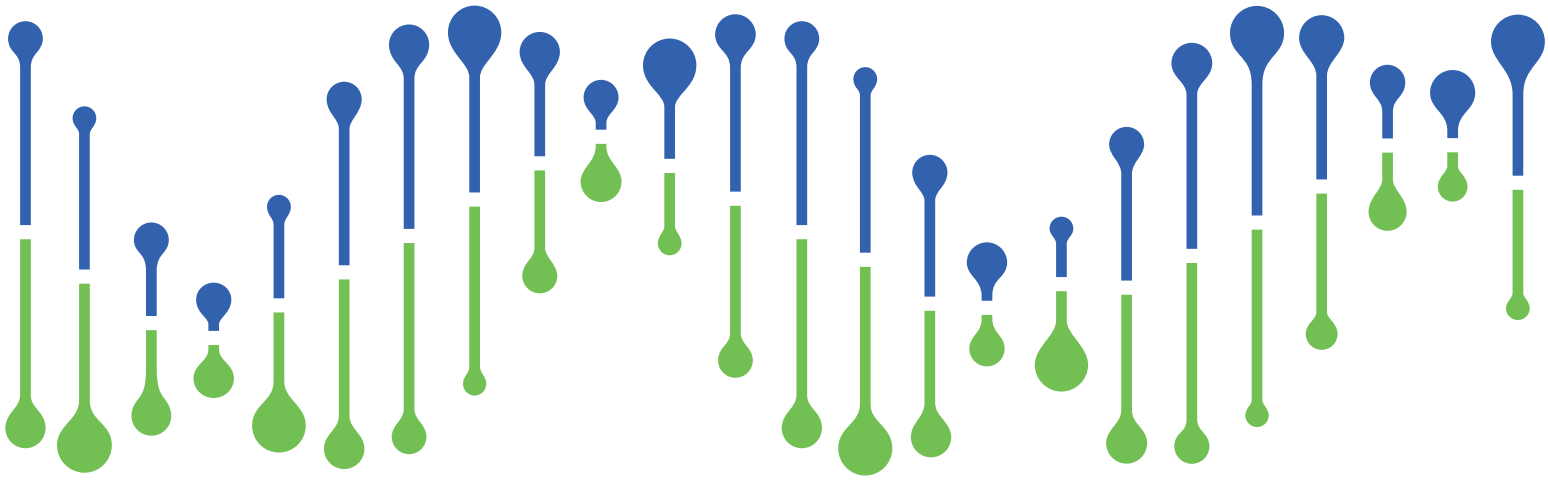
Cycle step	Temp.	Time	Cycles
Initial activation	98°C	3 min	1
Denaturation	95°C	10 sec	45
Annealing/Elongation	62°C	30 sec	

qPCR data analysis

Please note data analysis may vary between qPCR machines and thresholds must be determined empirically by the end user or laboratory. This assay has been designed specifically to be highly sensitive to the presence of male DNA against a background of female DNA. Therefore, the end user must ensure there is no possibility of male DNA contamination. Ideally and when possible, a trained female technician should perform the test.

Typically, a threshold of 40 cycles is used to determine whether the result is positive or negative for the presence of male DNA. CCR5 specific targets are used to determine if cell free DNA is present in the sample or not. We recommend using x3 replicates for each multiplex as this gives a total of 9 replicates from Y chromosome specific targets from which to interpret.

For further guidelines on how to analyse and interpret qPCR data generated by the Cell3™ Direct Fetal Sex Determination kit, please download the Analysis Guidelines document from our website. For further information on kit performance, please refer to our Cell3™ Direct Fetal Sex Determination datasheet.



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