

<b>Title of Qualification:</b>	<b>Qualification of Cryostem Freezing Medium</b>		
<b>Test Material Name and Lot #</b>	Cryostem Serum-free, animal components-free Freezing Medium, lot 1617350		
<b>Control Material Name and Lot #</b>	WiCell Cryopreservation Medium 11Nov16SS		
<b>Cell Culture Medium Used</b>	Medium Name: mTeSR1		
	Component	Manufacturer	Lot #
	Basal Medium	StemCell Technologies	15J66194
	5X Supplement	StemCell Technologies	15J66193
	250X Supplement	StemCell Technologies	15J66192
	Human FGF-2	Waisman Biomufacturing	WC-FGF2-FP-004
<b>Platform/Matrix (MEFs, matrigel, etc)</b>	Matrigel		
<b>Technician</b>	[REDACTED]		
<b>Start and End Dates of Qualification</b>	11Nov16 and 13Dec16		
<b>PSC line, lot, and thaw used</b>	IMR90-4-WB0088-T47356		
<b>Pre- Karyotype</b> (enter "Normal" or "Abnormal" and the sample #)	Normal Karyotype Sample #: 11978		
<b>Post-Karyotype for all three test vials</b> (enter "Normal" or "Abnormal" and the sample #)	Normal Karyotype Sample #: 12049, 12050, and 12051		
<b>QC Qualification Sample ID</b>	11931		

**Experimental design:**

Cryostem Serum-free, animal components-free Freezing Medium (lot 1617350) was tested for the ability to appropriately cryopreserve human pluripotent stem cells (PSCs) without affecting the undifferentiated state and expansion rate of the PSCs post thaw. PSCs were cryopreserved using Cryostem Freezing Medium (Test) and WiCell’s standard cryopreservation medium (Control). Both the Cryostem bank and control bank of cells originated from the same parent culture of recently karyotyped cells. Vials from each bank were thawed in triplicate on three separate occasions. Resulting morphology was assessed, as well as plating efficiency and expansion directly out of thaw and following the first passage. Cells were counted on day 1 post-thaw (P1 D1) and immediately pre-passage (P1 D3), as well as day one post passage (P2 D1) and immediately pre-passage at the second passage (P2 D3). In addition, at the conclusion of the assay (P2 D3), all cultures were submitted for karyotype and assayed via flow cytometry to determine the percent of undifferentiated cells. Testing was performed per WiCell’s SOP-QU-005-F, Quality Control Testing of Cell Culture Reagents. Documentation was recorded in notebook 187 pages 190-192 and notebook 190 pages 1-31.

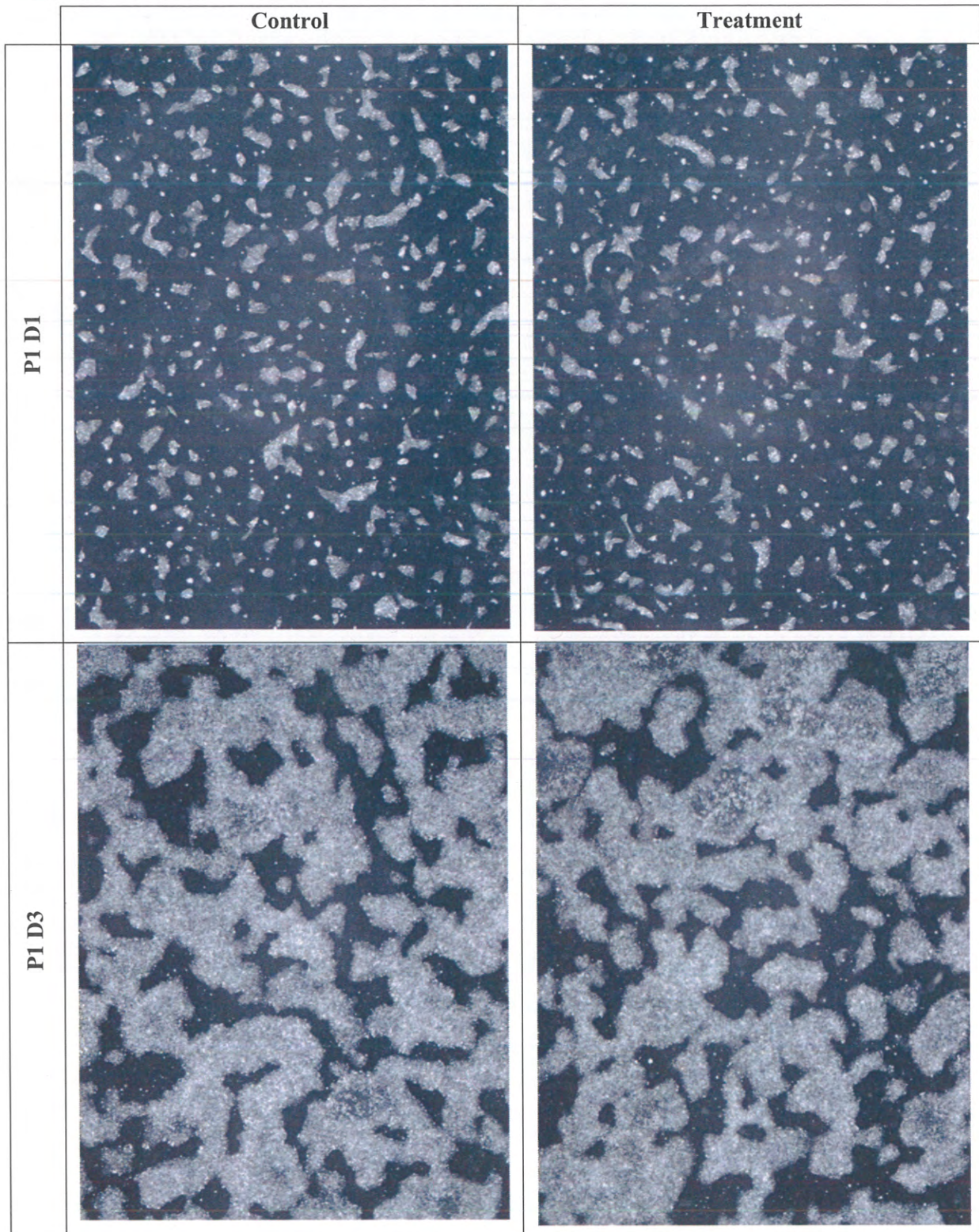
**Equipment:**

BioSafety Cabinet	3-digit equipment ID: 089	Room #: 119
Incubator	3-digit equipment ID: 124	Room #: 119
Microscope	3-digit equipment ID: 194	Room #: 119
Micropipettor	S/N: F0623217G	Room #: 119

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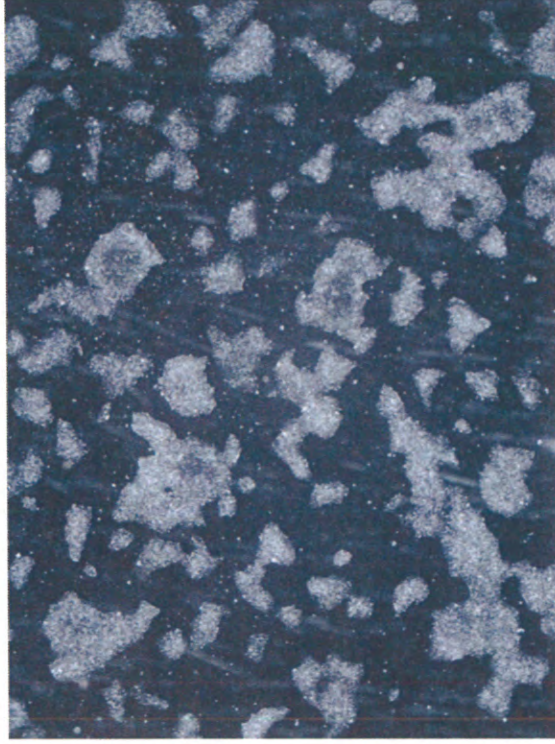
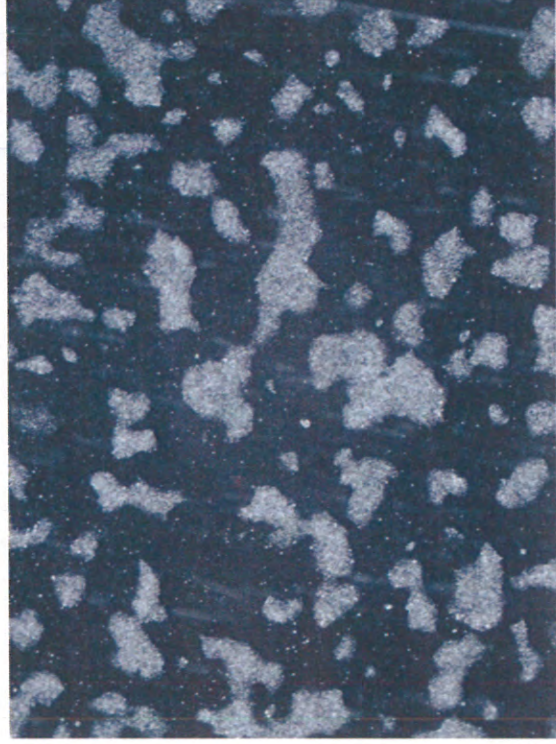


**Images of PSCs just prior to counting at 2x magnification:**



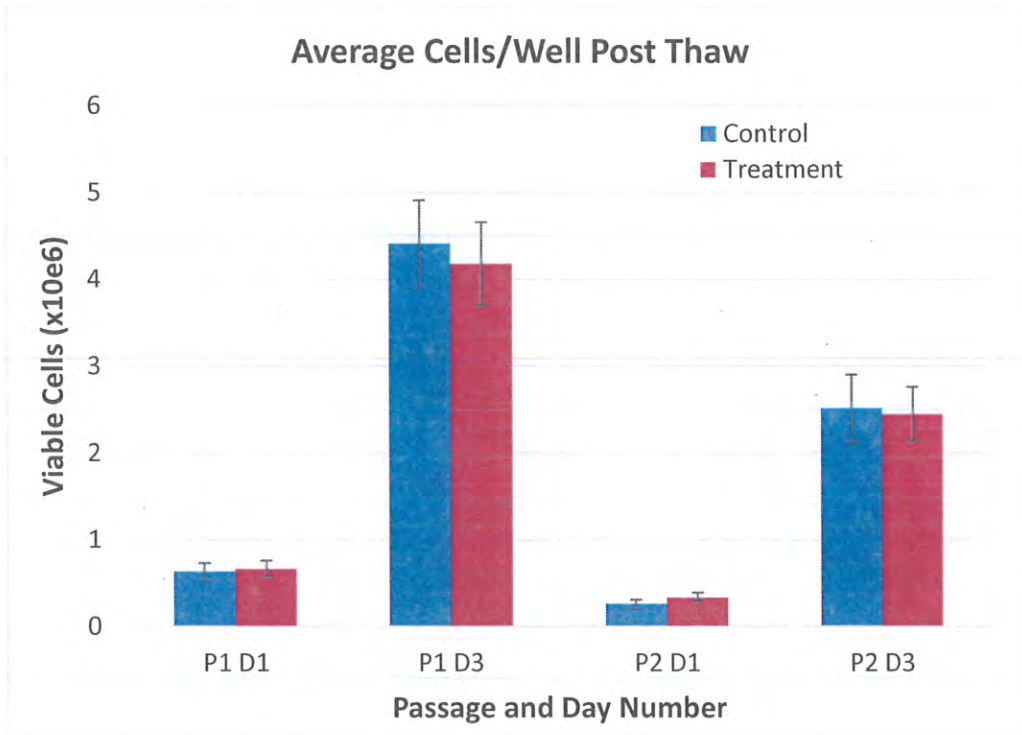
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	Control	Treatment
P2 D1		
P2 D3		

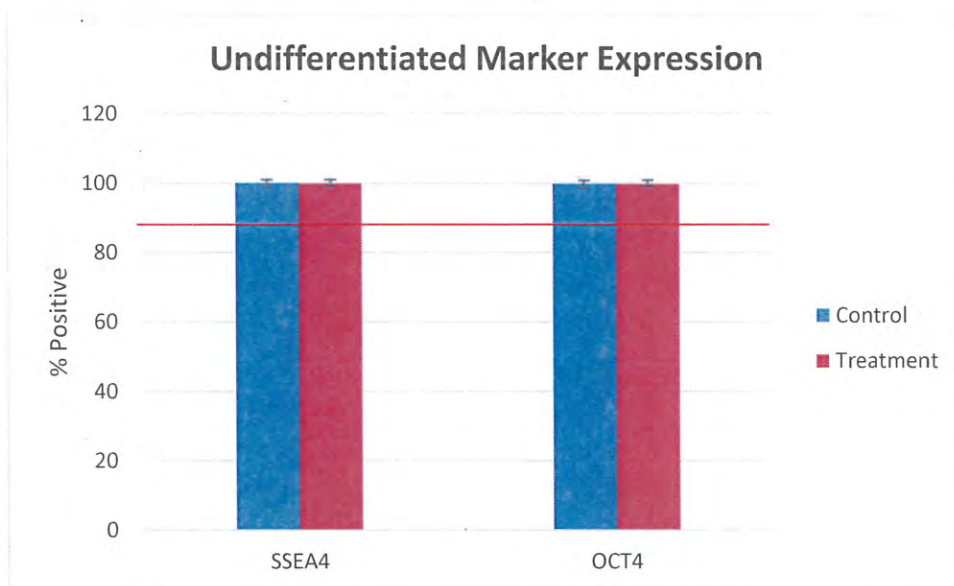
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**Proliferation Data:**



**Marker Expression:**

Minimal expression acceptable:  $\geq 85\%$  positive for Oct3/4 and SSEA4 markers for undifferentiated PSCs.



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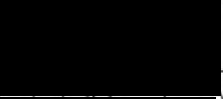


**Conclusions:**

No negative effect on cell proliferation, differentiation, morphology or karyotype was noted for human pluripotent cells cryopreserved using Cryostem Serum-free, Animal Components-free Freezing Medium (lot 1617350). Cells thawed from a lot cryopreserved using Cryostem have met all WiCell requirements for quality. Cryostem equivalent to lot 1617350, when used as directed, is appropriate for use in pluripotent cell culture cryopreservation.

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Technician Signature:		Date:	<u>03 Jan 17</u>
Reviewer Signature:		Date:	<u>03 JAN 17</u>
QA Signature:		Date:	<u>04 Jan 17</u>

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Date Reported: Monday, December 12, 2016

Cell Line: iPS(IMR90)-4-WB49934 12049

Passage#: 44

Date of Sample: 12/7/2016

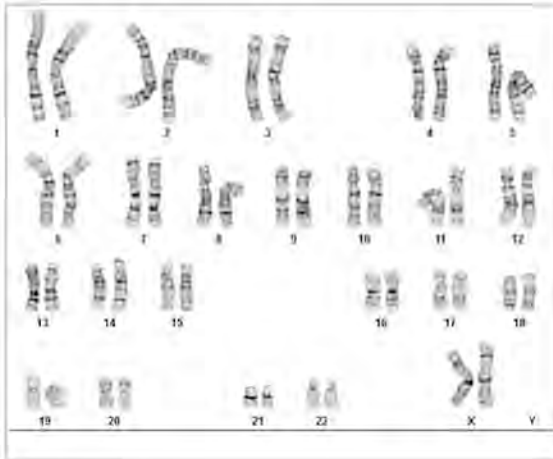
Specimen: iPSC

Results: 46,XX

Cell Line Gender: Female

Reason for Testing: QC 11931 Cryostem freezing medium 1617350 test vial #3

Investigator:



Cell: 12

Slide: 3

Slide Type: Karyotype

Total Counted: 20

Total Analyzed: 8

Total Karyogrammed: 4

Band Resolution: 500 - 550

### Interpretation:

**This is a normal karyotype. No clonal abnormalities were detected at the stated band level of resolution.**

Completed by:

Reviewed and Interpreted by:

**A signed copy of this report is available upon request.**

Date: \_\_\_\_\_ Sent By: \_\_\_\_\_ Sent To: \_\_\_\_\_ QC Review By: \_\_\_\_\_

*Limitations: This assay allows for microscopic visualization of numerical and structural chromosome abnormalities. The size of structural abnormality that can be detected is >3-10Mb, dependent upon the G-band resolution obtained from this specimen. For the purposes of this report, band level is defined as the number of G-bands per haploid genome. It is documented here as "band level", i.e., the range of bands determined from the four karyograms in this assay. Detection of heterogeneity of clonal cell populations in this specimen (i.e., mosaicism) is limited by the number of metaphase cells examined, documented here as "# of cells counted".*

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Date Reported: Monday, December 12, 2016

Cell Line: iPS(IMR90)-4-WB49934 12050

Passage#: 44

Date of Sample: 12/7/2016

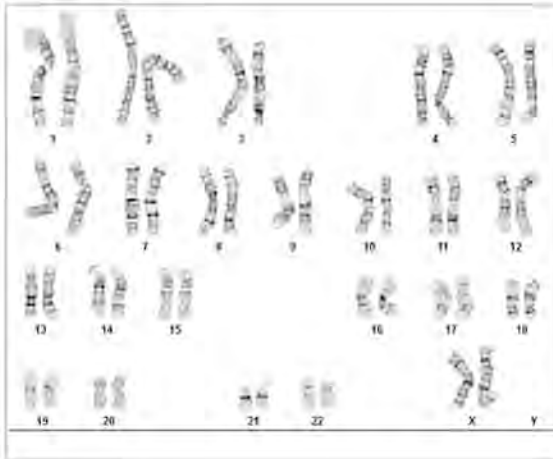
Specimen: iPSC

Results: 46,XX

Cell Line Gender: Female

Reason for Testing: QC 11931 Cryostem freezing medium 1617350 test vial #2

Investigator:



Cell: 14

Slide: 1

Slide Type: Karyotype

Total Counted: 20

Total Analyzed: 8

Total Karyogrammed: 4

Band Resolution: 475 - 575

### Interpretation:

**This is a normal karyotype. No clonal abnormalities were detected at the stated band level of resolution.**

Completed by:

Reviewed and Interpreted by: .

**A signed copy of this report is available upon request.**

Date: \_\_\_\_\_ Sent By: \_\_\_\_\_ Sent To: \_\_\_\_\_ QC Review By: \_\_\_\_\_

*Limitations: This assay allows for microscopic visualization of numerical and structural chromosome abnormalities. The size of structural abnormality that can be detected is >3-10Mb, dependent upon the G-band resolution obtained from this specimen. For the purposes of this report, band level is defined as the number of G-bands per haploid genome. It is documented here as "band level", i.e., the range of bands determined from the four karyograms in this assay. Detection of heterogeneity of clonal cell populations in this specimen (i.e., mosaicism) is limited by the number of metaphase cells examined, documented here as "# of cells counted".*

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**Date Reported:** Monday, December 12, 2016

**Cell Line:** iPS(IMR90)-4-WB49934 12051

**Passage#:** 44

**Date of Sample:** 12/7/2016

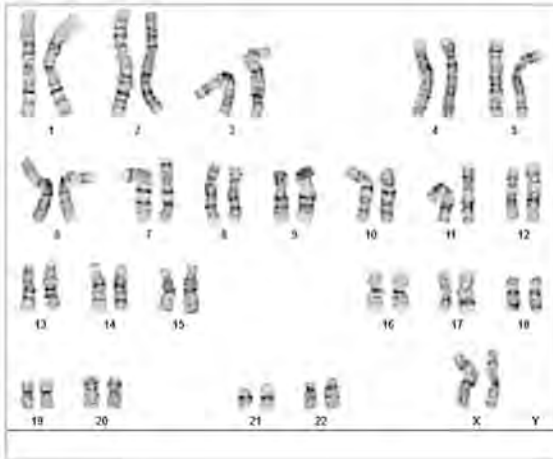
**Specimen:** iPSC

**Results:** 46,XX

**Cell Line Gender:** Female

**Reason for Testing:** QC 11931 Cryostem freezing medium 1617350 test vial #1

**Investigator:**



**Cell:** 35

**Slide:** 2

**Slide Type:** Karyotype

**Total Counted:** 20

**Total Analyzed:** 9

**Total Karyogrammed:** 4

**Band Resolution:** 500 - 550

**Interpretation:**

**This is a normal karyotype. No clonal abnormalities were detected at the stated band level of resolution.**

**Completed by:**

**Reviewed and Interpreted by:**

**A signed copy of this report is available upon request.**

**Date:** \_\_\_\_\_ **Sent By:** \_\_\_\_\_ **Sent To:** \_\_\_\_\_ **QC Review By:** \_\_\_\_\_

*Limitations: This assay allows for microscopic visualization of numerical and structural chromosome abnormalities. The size of structural abnormality that can be detected is >3-10Mb, dependent upon the G-band resolution obtained from this specimen. For the purposes of this report, band level is defined as the number of G-bands per haploid genome. It is documented here as "band level", i.e., the range of bands determined from the four karyograms in this assay. Detection of heterogeneity of clonal cell populations in this specimen (i.e., mosaicism) is limited by the number of metaphase cells examined, documented here as "# of cells counted".*

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