SARTORIUS

Product Datasheet

NutriStor® Cold Storage Solution

A serum-free, animal component-free (ACF) and protein-free solution, for short-term, non-cryogenic (2–8 °C) storage of cells

NutriStor® Cold Storage Solution is designed for the storage of sensitive cells without the need of repeated freeze-thaw cycles and multiple centrifugation steps. It has been tested on a variety of cells (including peripheral blood mononuclear cells (PBMCs), chimeric antigen receptor T-cells (CAR-Ts) and mesenchymal stromal cells (MSCs) from various sources and optimized to ensure maximum safety and high viability after cold storage.

NutriStor® Cold Storage Solution diminishes temperature induced cell stress responses that take place during hypothermic storage and shipping of cells, and provides maximum stability at 2–8 °C . It has been proven very effective in reducing post-storage necrosis and apoptosis that often occurs in cells during these procedures.

With components that provide pH buffering, osmotic support, energy substrates, and ionic concentrations, cells stored in this ACF solution show high recovery rates, normal cell characterization, and excellent performance.

- Ready-to-use
- Chemically defined, Animal Component-Free, Serum-Free, Protein-Free formulation
- Provides maximum safety during cold storage (2–8 °C)
- Ensures high viability and recovery rates after cold storage
- Ensures cell safety during shipment
- Reduces post storage necrosis and apoptosis
- Optimal for a wide range of applications
- DMF will be available
- Outperforms predominant market competitor

Relevant Applications

- Short-term cell storage (avoids the need for cryopreservation and freez-thaw cycles)
- Shipment of cells in cold storage rather than in LN2
- Clinical applications (e.g., Immunotherapy, CAR-T, Tissue regeneration, etc.)
- All applications involving PBMCs, hMSCs and T-cells

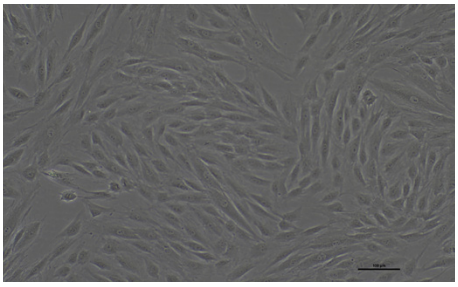
Relevant Process Steps

- Cell suspension
- Cell storage
- Cell shipment
- Cell recovery in culture media (dependent on cell type)

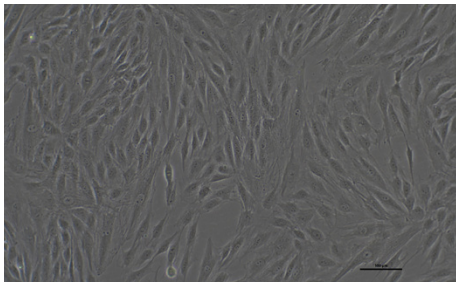
Technical Specifications

Volume	10 mL	100 mL	250 mL	500 mL
Bottle|Bag	bottle	bottle	bag	Bag|bottle

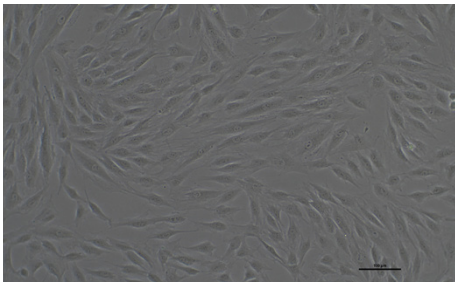
Figure 1: *A comparison between cells stored in NutriStor® Cold Storage solution and NutriFreez® D10 cryopreservation media.*



Sample 1
Cells after storage in NutriStor®.
Initial seeding: 44.0×10³ cells/cm²



Sample 2
Cells after storage in NutriStor®.
Initial seeding: 44.8×10³ cells/cm²

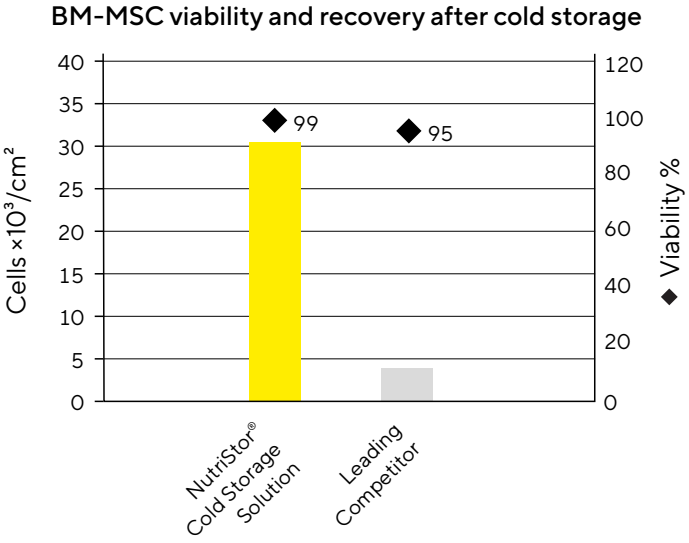


Positive control
Cells after cryopreservation in NutiFreez® D10.
Initial seeding: 41.8×10³ cells/cm²

Note: Representative images (×100) of human BM-MSCs after a 3-day storage in NutriStor® Cold Storage solution. After storage, the cells were seeded for recovery with MSC NutriStem® XF Medium. Cells were counted and images were taken 3 days post-seeding. The cells stored in NutriStor® Cold Storage Solution showed impressive results, with high recovery and proliferation rates, and normal morphology.

Figure 2: *NutriStor® Cold Storage Solution – Viability and Recovery.*

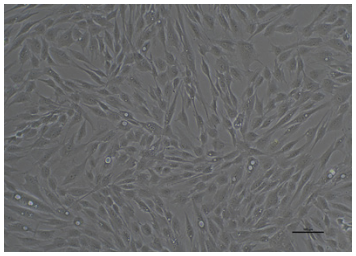
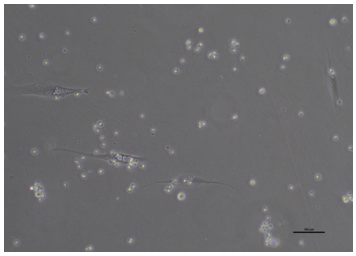
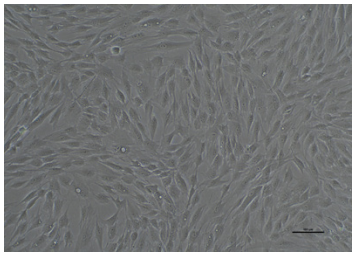
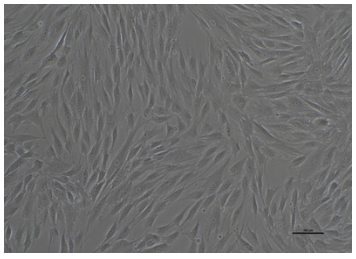
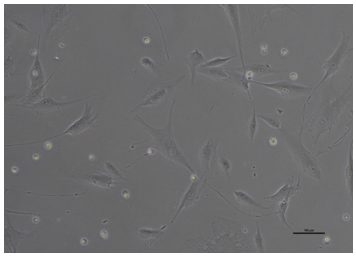
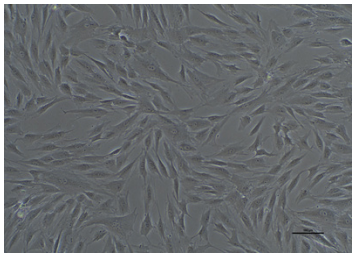
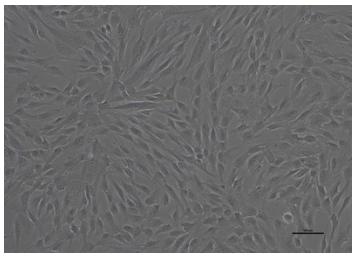
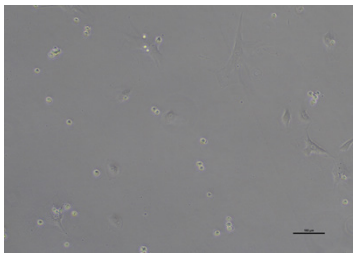
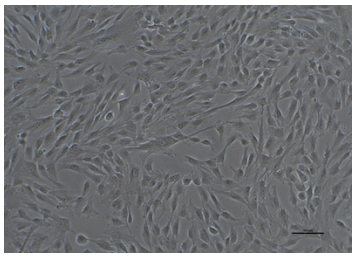
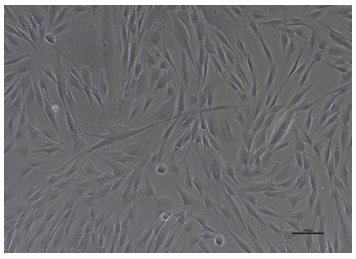
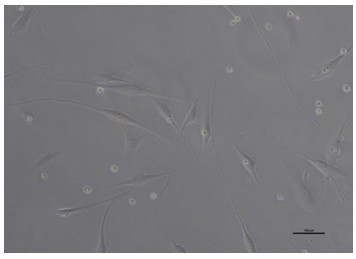
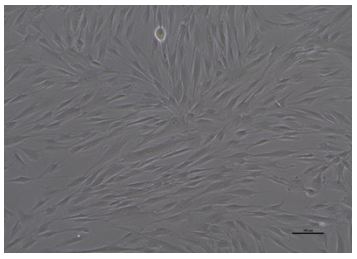
Note: An evaluation of viability and recovery rates of human BM-MSCs stored in NutriStor® Cold Storage Solution compared to cells stored in the leading market competitor. Cells were stored for 4 days in storage solution, at 4 °C (Stored cell concentration was ~330k cells/vial [1 mL/vial]).
After storage live cells were counted (viability) and seeded in 12 well plates, at a concentration of 5×10³ cells/cm² (2×10⁴ cells/well) in 1 mL/well MSC NutriStem® XF Medium. Plates were pre-coated with MSC Attachment Solution. Although both groups showed excellent viability rates, cells stored in NutriStor® Cold Storage Solution showed much higher recovery rates, compared to cells stored in the leading competitor.



The following assays characterize various cell functions and characteristics after storage in different storage solutions. All assays (figures 3–6) are based on human MSCs (Bone Marrow (BM), Adipose Tissue (AT), Cord Tissue (CT) or Dental Pulp (DP) derived) stored for 4 days in NutriStor® Cold Storage Solution or in the current market leading competitor solution (2–8 °C).

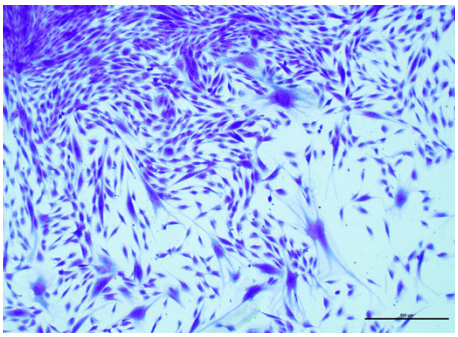
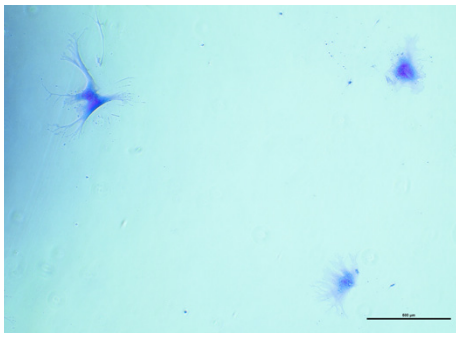
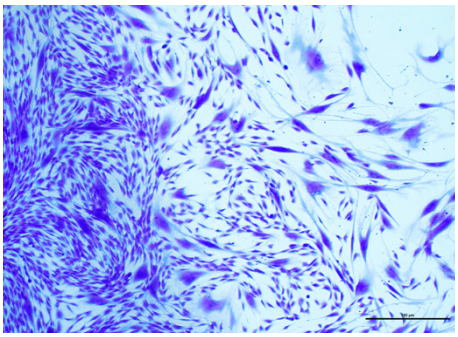
As a positive control (PC) cells from the same source were stored in NutriFreez® D10 (–150 °C). Figure 7 represents the same comparison based on Peripheral Blood Mononuclear Cells (PBMCs) with NutriFreez® D5 cryopreservation solution as a positive control.

Figure 3: *Recovery of hMSCs from different sources.*

NutriStor® Cold Storage Solution	Leading competitor	NutriFreez® D10 (PC)
AT-MSCs		
		
52×10³ cells/cm²	1×10³ cells/cm²	59×10³ cells/cm²
BM-MSCs		
		
36×10³ cells/cm²	5×10³ cells/cm²	43×10³ cells/cm²
CT-MSCs		
		
49×10³ cells/cm²	3×10³ cells/cm²	57×10³ cells/cm²
DP-MSCs		
		
34×10³ cells/cm²	5×10³ cells/cm²	40×10³ cells/cm²

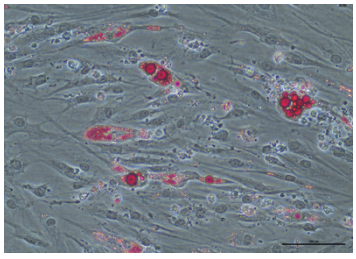
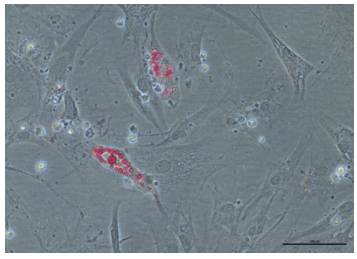
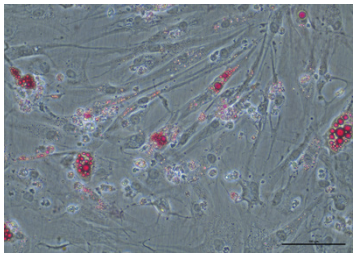
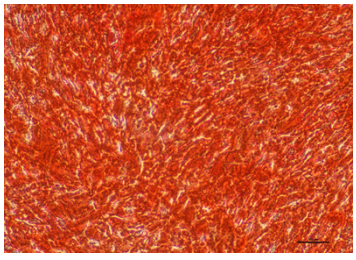
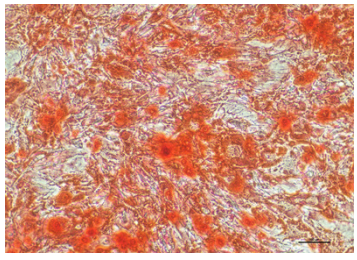
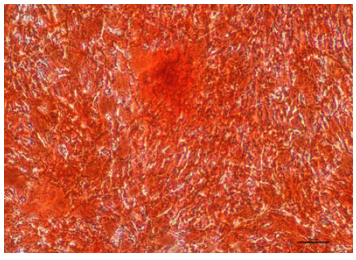
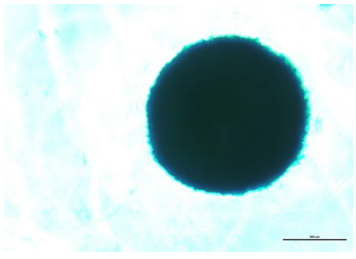
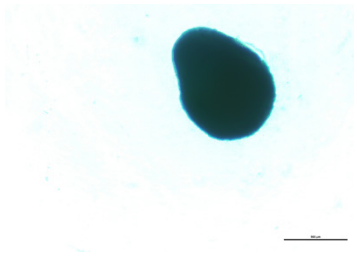
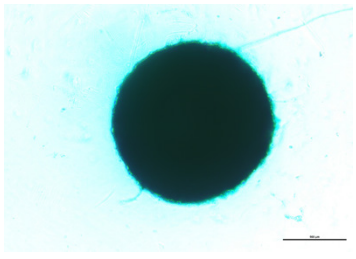
Note: Representative images of AT/BM/CT and DP MSCs, after storage in either NutriStor® Cold Storage Solution or leading Competitor (2–8 °C). Images and cell counts (presented on each image) indicate that Cells stored in NutriStor® Cold Storage Solution showed significantly better recovery rates than leading competitor.

Figure 4: *CFU-F assay. Self-renewal potential of hMSCs after cold storage.*

NutriStor® Cold Storage Solution	Leading competitor	NutriFreez® D10 (PC)
		

Note: Representative images (×40) of mature BM-MSC colony forming units, stained with 0.5% Crystal violet. Images were taken post 14 days of CFU-F assay. After storage in cold storage solution, cells were seeded at a concentration of 100 cells/well, to assess colony-forming potential. Cells stored in NutriStor® Cold Storage Solution showed much higher colony-forming potential than Leading competitor. Morphology was similar in NutriStor® and PC wells. Similar results were obtained while testing AT/CT and DP-derived MSCs.

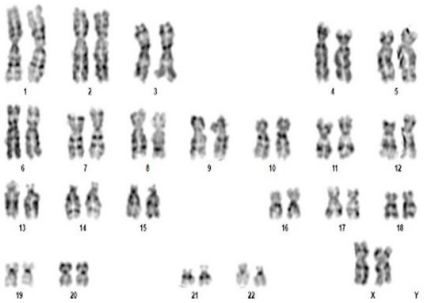
Figure 5: *Differentiation potential of MSCs after cold storage.*

	NutriStor® Cold Storage Solution	Leading competitor	NutriFreez® D10 (PC)
Adipogenesis (20-day assay) Images (×200) Oil red O staining			
Osteogenesis (15-day assay) Images (×100) 2% ARS staining			
Chondrogenesis (28-day assay) Images (×40) 1% Alcian Blue staining			

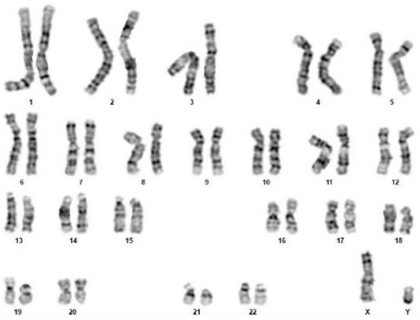
Note: Representative images of BM-MSCs, after various differentiation assays (Adipogenesis, Osteogenesis and Chondrogenesis). Mature differentiated cells were observed in all storage and frozen samples. Cell morphology and confluency were similar in NutriStor® Cold Storage Solution and PC samples. Very few mature adipocytes were observed in the leading competitor samples, with a different cell morphology (elongated) and many dead cells present. Osteogenesis results of the leading competitor showed a very low differentiation capacity. In the chondrogenesis assay the NutriStor® and NutriFreez® chondrocyte colony shape and size indicated that the differentiation was significantly more efficient.
Similar results were observed in the AT/CT and DP-derived MSC samples.

Figure 6: *Genomic stability of various hMSCs.*

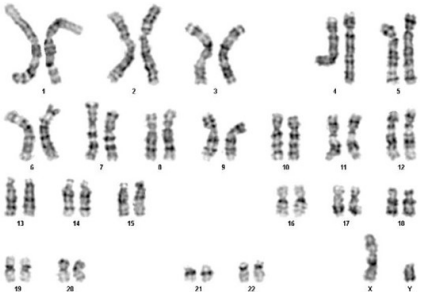
AT-MSCs



BM-MSCs



CT-MSCs

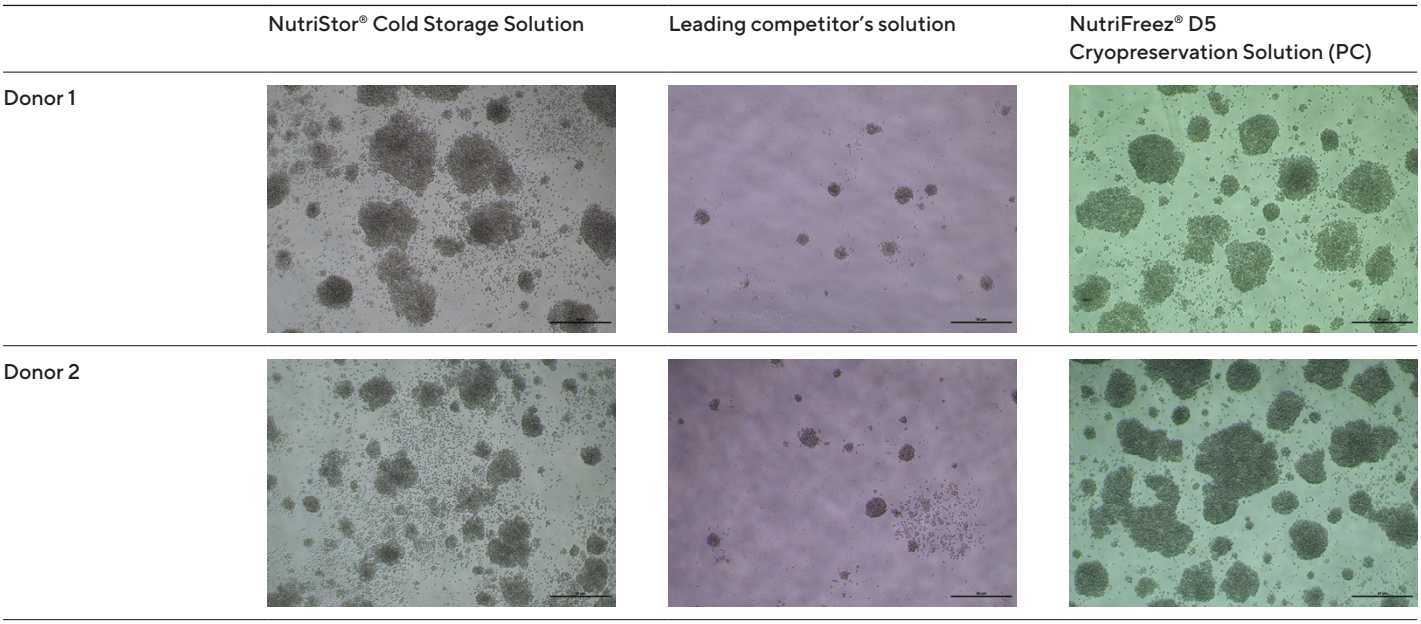


DP-MSCs

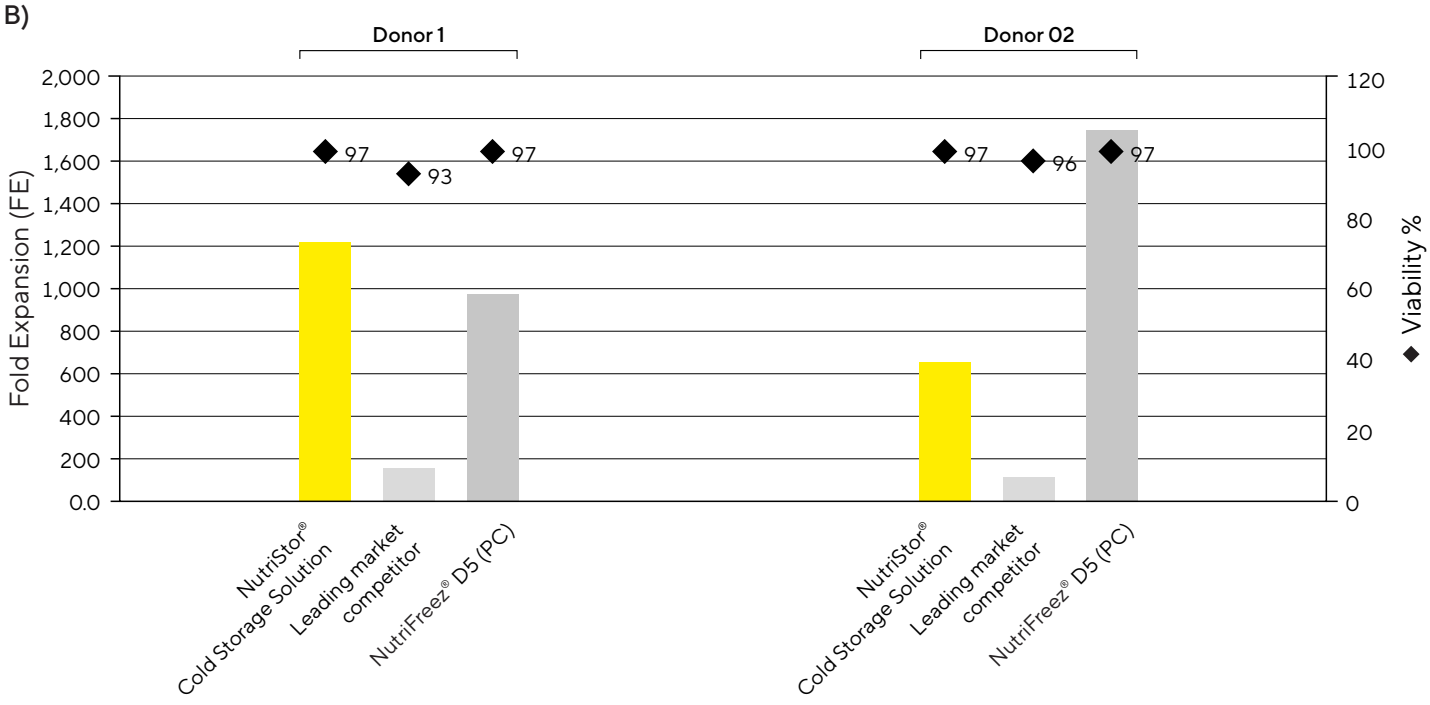
Note: G-banding Karyotype analysis of AT, BM, CT, and DP-derived MSCs after 4 days of storage in NutriStor® Cold Storage Solution (2–8 °C). Images show MSCs maintain genomic stability after being stored in NutriStor® Cold Storage Solution. Normal 46XY or 46XX karyotype was observed in all samples.

Figure 7: *PBMC culture viability and recovery, NutriStor® Cold Storage Solution vs. Leading competitor.*

A)



B)



Note: Fresh cells from two healthy donors were stored in NutriStor® Cold Storage Solution or in the leading competitor's solution, for 4 days, at 4° C, 5–6×10^6 cells/mL per vial [1 mL/vial]). NutriFreez® D5 cryopreservation solution served as a positive control. The cells were seeded post-storage in Nutri-T XF medium in 24 well plates, at a concentration of 50×10^3 cells/well, and cultured for 8 days with a passage on day 5. (A) Light microscopy images taken on day 5 post-seeding. PBMCs stored in NutriStor® Cold Storage Solution or PC showed typical culture morphology and higher proliferation rates than the competitor's solution. (B) Cells were counted, and fold expansion (FE) was evaluated as a recovery indicator on day 8. Though viability results were good in both solutions, PBMCs stored in NutriStor® showed higher viability and significantly higher FE results than the cells stored in the competitor's solution.

Ordering Information

Item	Description	Volume	Order Number
NutriStor® Cold Storage Solution	10 mL bottle	10 mL	05-F3F3001-1D
NutriStor® Cold Storage Solution	100 mL bottle	100 mL	05-F3F3001-1B
NutriStor® Cold Storage Solution	500 mL bottle	500 mL	05-F3F3001-1A
NutriStor® Cold Storage Solution	250 mL FlexSafe® bag	250 mL	05-F3F3001-1-0.25L
NutriStor® Cold Storage Solution	500 mL FlexSafe® bag	500 mL	05-F3F3001-1-0.5L

Peripherals and Accessories

Product Name	Order Number
MSC NutriStem® XF Media	05-200-1 + 05-201-1
4Cell® Nutri-T GMP	05-F3F2111-1K

Germany
Sartorius Stedim Biotech GmbH
August-Spindler-Strasse 11
37079 Goettingen
Phone +49 551 308 0

Israel
Biological Industries Israel
Beit Haemek Ltd.
Kibbutz Beit Haemek 2511500
Phone +972 4 9960595

USA
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565 Johnson Avenue
Bohemia, NY 11716
Toll-Free +1 800 368 7178

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