BioResearch

Lonza

Stem Cell Research Tools for Biologically Relevant Results

It All Stems from Here – Simplify Your Reprogramming, Proliferation

"I can't find a reliable solution for generation and expansion of iPSCs suited for research and clinical applications"

SOLUTION: The new L7™ hiPSC Reprogramming and hPSC Culture System provides a complete, xeno-free solution from reprogramming to growth and expansion.
Page 5

iPSC Workflow

"How can I feed my hPSCs every other day while still maintaining normal karyotype and differentiation potential?"

SOLUTION: Lonza now offers the L7™ hPSC Culture System - a xeno-free, defined system that allows for every other day feeding of hPSCs.
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PSC Culture

and Differentiation

"How can I stably modulate gene expression in pluripotent stem cells?"

SOLUTION: Our non-viral Nucleofector™ Technology allows simple and reliable genome editing of ESCs, iPSCs or other cells using ZFN, TALEN or CRISPR/Cas9 technologies.

Page 11

Genome Editing

"How can I get the full differentiation potential from my stem cells?"

SOLUTION: Lonza stem cells have high purity and homogeneity (confirmed by FACS analysis of positive and negative markers).

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Adult Stem Cells

Your Stem Cell Research Toolkit

Lonza offers convenient solutions to help scientists overcome a variety of stem cell research challenges whether working with adult stem cells or pluripotent stem cells. Our integrated products are optimized and tested together to provide superior results. We supply high-quality primary and stem cell-derived cell types, with optimized medium and proven protocols; superior transfection technology (even for the most challenging cell types), and a wide range of cell analysis tools.

Pluripotent Stem Cells

Reprogramming
- Nucleofector™ Technology for efficient reprogramming of e.g. fibroblasts, PBMCs, CD34
- L7™ PBMC Reprogramming Bundle for reliable generation of iPSCs from mononuclear cells

Proliferation
- L7™ hPSC Culture System
- Lonza's pluripotent services

Differentiation and Modification
- Nucleofector™ Technology for genome editing in ESCs or iPSCs using ZFN, TALEN and CRISPR systems
- PSC derived primary cells

Adult Stem Cells

Proliferation
- Broad collection of adult stem cells, progenitors or precursors with optimized growth media, e.g. mesenchymal, adipose-derived or dental pulp stem cells as well as pre-adipocytes, hematopoietic cells and neural progenitors

Differentiation and Modification
- Specialized media for adipose, chondrogenic and osteogenic differentiation of human MSCs
- Nucleofector™ Technology with optimized protocols for transfection of primary adult stem cells, e.g. human MSC, human ADSCs, rat/mouse NSCs

Cell Analysis Tools

Living Cell Imaging
- **CytoSMART™ System: small, easy and affordable life cell imaging system for documentation of iPSC generation or monitoring of stem cells cultured under hypoxic conditions**

Cell Analysis Tools
- **Collection of tools to analyze viability or functionality of stem cells or stem cell-derived cells**

Pluripotent Stem Cells – Reprogramming

L7™ hiPSC Reprogramming and hPSC Culture System

In 2014 Lonza introduced its new L7™ hiPSC Reprogramming and hPSC Culture System for basic stem-cell research, disease modeling, drug development and regenerative medicine. Our offering includes innovative tools to simplify and streamline the stem-cell culturing and reprogramming workflow. The novel L7™ PSC Culture System supports the generation of reproducible, clinically relevant data as a solid basis for more efficient drug development and accelerated progress in regenerative medicine.

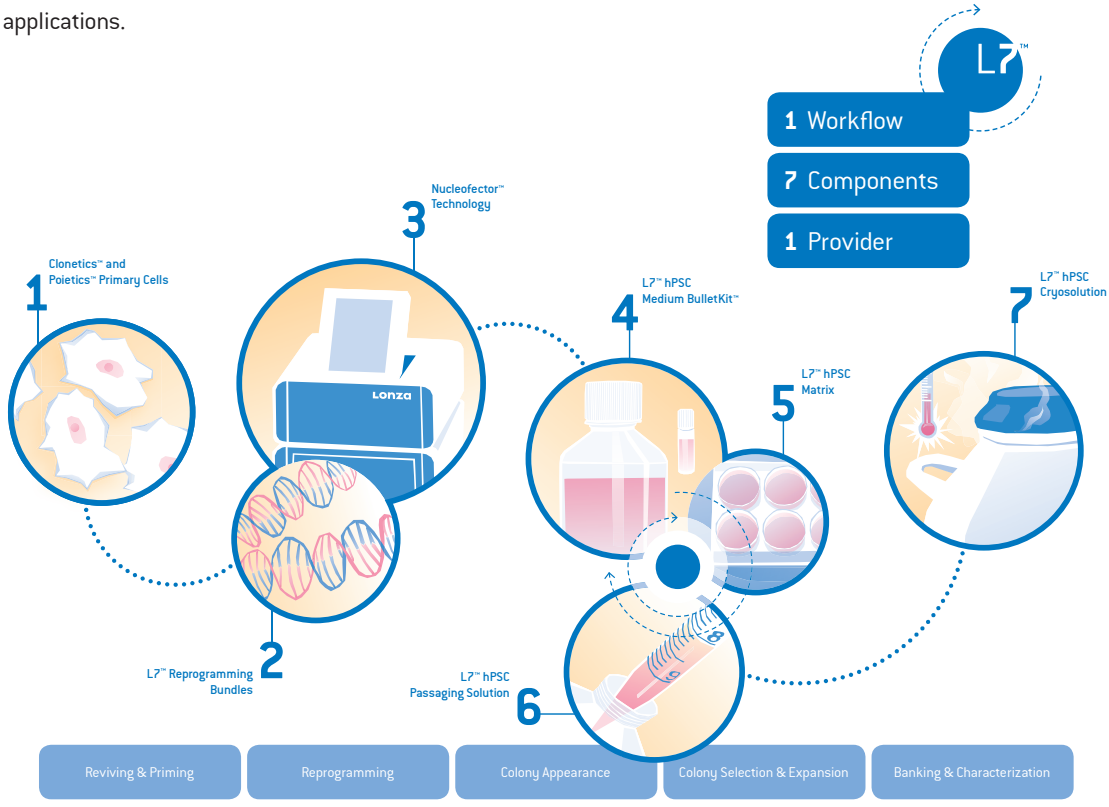
The L7™ hiPSC Reprogramming and hPSC Culture System includes seven key components that are aligned and function as a robust workflow.

This novel culture system is the only available complete solution for the generation of induced pluripotent stem-cells (iPSCs), the maintenance of human embryonic stem cells (hESCs) and iPSCs under defined, xeno-free conditions. The culture system allows for every other day feeding and supports long term culture and maintenance of hPSCs. The L7™ hiPSC Reprogramming and hPSC Culture System thus provides a seamless transition from the lab bench to clinical development applications.

"I can't find a reliable solution for generation and expansion of iPSCs suited for research and clinical applications"

SOLUTION:
The new L7™ hiPSC Reprogramming and hPSC Culture System provides a complete, xeno-free solution from reprogramming to growth and expansion. ZFN, TALEN or CRISPR.

www.lonza.com/L7 – for further information



Pluripotent Stem Cells – Reprogramming

Nucleofector™ Technology - For iPSC Generation

The Nucleofector™ Technology has been demonstrated to be an efficient and cost-effective non-viral alternative for iPSC generation and is being used by leading scientists around the world.

Nucleofection benefits for reprogramming:

- Simple, single-step procedure to introduce DNA/RNA
- Successfully tested for generation of iPSCs from various cell types, including PBMCs and fibroblasts
- NEW - Fully defined protocol for PBMC reprogramming using the 4D-Nucleofector™ System (L7™ PBMC Reprogramming Bundle)
- Seamless workflow in combination with our L7™ hPSC Culture System for feeder- and xeno-free iPSC culture
- Availability of 4D-Nucleofector™ Kits with cGMP Solutions

Transfection Results for Typical Reprogramming Starter Cells

	Efficiency*	Viability*	Kit for 4D-Nucleofector™ and 96-well Shuttle™ Systems	Kit for Nucleofector™ II/2b Device
Primary Cells				
Adipose-derived stem cells, human (ADSC)	73–94%	58–85%	P1 Primary Cell	Human MSC
$CD34^+$ cells, human	66–83%	62–70%	P3 Primary Cell	Human CD34
Fibroblasts	40–95%		P2 Primary Cell	Human Fibroblast
Keratinocytes	40–80%		P3 Primary Cell	Human Keratinocyte
PBMCs	30–95%		P3 Primary Cell	Human T Cell

www.lonza.com/celldatabase – for further information and protocol guidance

L7™ PBMC Reprogramming Bundle

Using the 4D-Nucleofector™ System, Lonza's Pluripotent Stem Cell Innovation Team has developed an optimized protocol for reprogramming of PBMCs (erythroblast population) using episomal vectors.

Components required to run the optimized protocol:

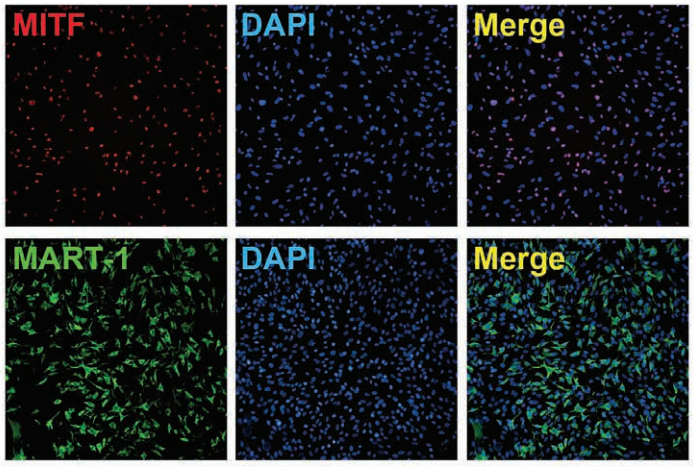
- Lonza Human Peripheral Blood Mononuclear Cells as positive control donor
- NEW - **L7™ hPSC Reprogramming Bundle**
  - L7™ PBMC Priming-Recovery Basal Medium for priming of PBMCs towards erythroblasts prior to reprogramming and optimal recovery post transfection
  - L7™ PBMC Reprogramming Enhancers A and B for optimal reprogramming results
- 4D-Nucleofector™ X Unit
- P3 Primary Cell 4D-Nucleofector™ Kit

Pluripotent Stem Cells – Reprogramming Case Study

Lonza L7™ hiPSC Reprogramming and hPSC Culture System

By Ha T. Tran[1], Rex E. Lacambacal[1,2], Candace L. Lynch[1], Jeanne F. Loring[1], Inbar Friedrich Ben-Nun[3], Yu-Chieh Wang[1,4]
1) Department of Chemical Physiology, Center for Regenerative Medicine, The Scripps Research Institute, La Jolla, CA, USA; 2) California State University, Channel Islands, CA, USA; 3) Lonza Walkersville, Inc., Walkersville, MD, USA; 4) Department of Pharmaceutical Sciences, University of North Texas Health Science Center, Fort Worth, TX, USA

In this study, the authors evaluated the Lonza protocol for a certain individual – referred to as individual #418 – for which various reprogramming attempts had failed thus far. Previously, they successfully generated hiPSCs from primary cells of numerous individuals using retro- or Sendai virus-mediated methods. However, in the case of individual #418, these approaches failed to yield colonies following transduction attempts with both dermal fibroblasts from several biopsies and epithelial cells from urine samples. Using the Lonza L7™ hiPSC Reprogramming and hPSC Culture System, they have generated hiPSCs from PBMCs of individual #418. The data presented in the article demonstrate that the Lonza protocol can be used for the generation of high quality hiPSCs, capable of maintaining their differentiation potential. Pluripotency of the hiPSCs was maintained as demonstrated by subsequent non-directed differentiation (EB formation) and directed differentiation (melanocyte differentiation).



Directed differentiation of PBMC418iPS1506 hiPSCs into melanocytic cells. The differentiated derivatives (PBMC418iPS1506_Mel Diff) expressed melanocytic biomarkers MITF and MART-1.

For complete article see: Lonza Resource Notes, Fall 2014, page 8-11.

Pluripotent Stem Cells – Proliferation

L7™ hPSC Culture System

The L7™ hPSC Culture system is a complete system for the maintenance of human ESCs and iPSCs. It is a xeno-free, fully defined, robust system that reduces the PSC workload by supporting every other day feeding of hPSCs. The L7™ hPSC Culture System supports efficient differentiation while maintaining pluripotency marker expression, karyotype and morphology for over 40+ passages with various hiPSC and hESC lines. The L7™ hPSC Culture System also allows for easy transition to clinical applications. This same system is used by Lonza's Services group to create clinical grade master cell banks for various clinical institutions around the world.

"How can I feed my hPSCs every other day while still maintaining normal karyotype and differentiation potential?"

SOLUTION:
Lonza now offers the L7™ hPSC Culture System - a xeno-free, defined system that allows for every other day feeding of hPSCs.

L7™ hPSC Basal Medium and Medium Supplement

Lonza took a different approach when developing its hPSC culture system. Instead of using DMEM-F/12, we decided to design a basal medium specifically for culturing PSCs. We then used an experimental approach to assemble the optimal combination and concentrations of growth factors and cytokines that support the long-term growth and maintenance of these undifferentiated PSCs.

L7™ hPSC Matrix

Lonza's recombinant hPSC substrate is xeno-free and defined. When used in conjunction with L7™ hPSC Medium, it is proven to support efficient attachment, maintain pluripotency and a stable karyotype for over 40+ passages in multiple hPSC lines.

L7™ hPSC Passaging Solution

Lonza's L7™ hPSC Passaging Solution is a chemically-defined, non-enzymatic cell detachment formulation based on a hypertonic sodium citrate solution. It gently dislodges multicellular colony fragments without the need for mechanical manipulation of the cultures. This user friendly method simplifies routine maintenance of your valuable hESC and iPSC lines.

L7™ hPSC Cryosolution

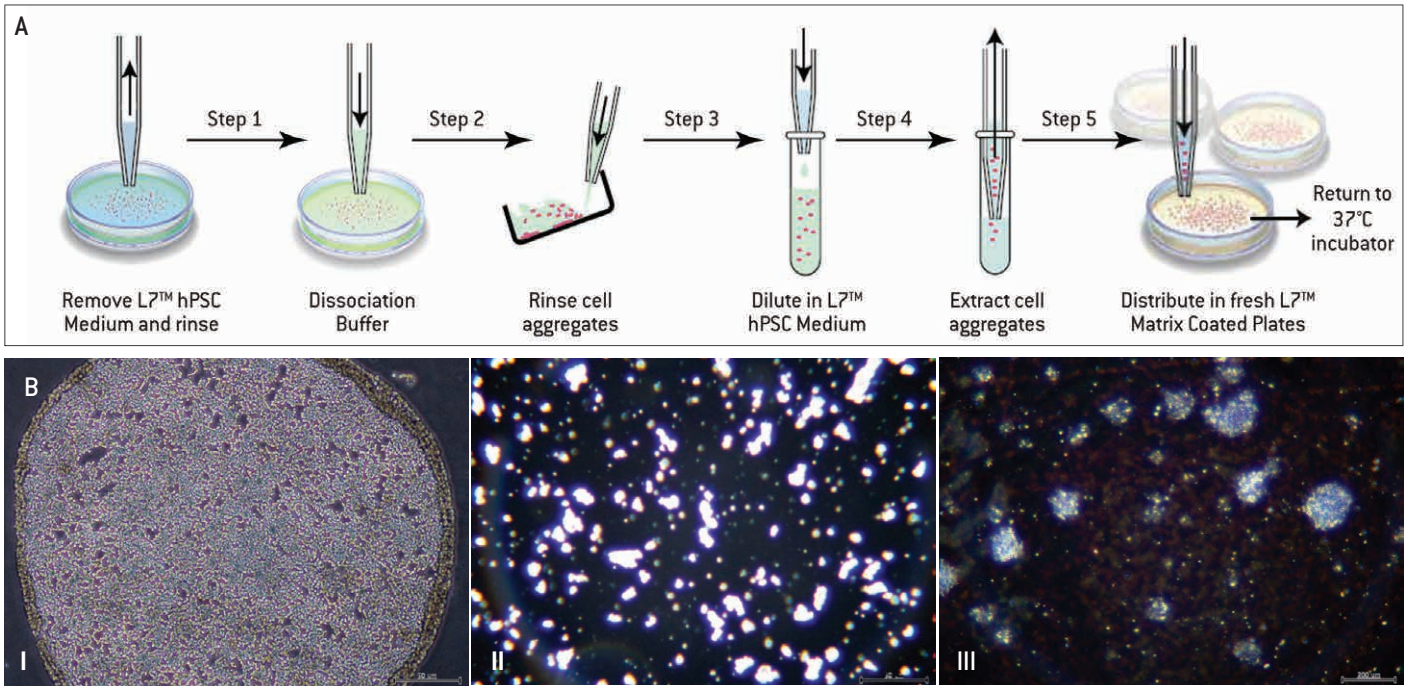
Lonza's cryopreservation cocktail supports efficient recovery of cryopreserved hPSCs under xeno-free and defined conditions.

Pluripotent Stem Cells – Proliferation Case Study

An hPSC Culture System for Research and Future Clinical Applications

By Ashish Mehta[1], Chrishan JA Ramachandra[1], Glen L Sequiera[1], Scott D'Andrea[2], Amber Ellis[2], Winston Shim[1,3]
1) National Heart Research Institute Singapore, Singapore; 2) Lonza Walkersville, Inc., Walkersville, MD, USA; 3) DUKE-NUS, Singapore

The L7™ hPSC Culture System was evaluated by researchers at the National Heart Research Institute in Singapore by using human embryonic stem cells and lab generated induced pluripotent stem cells. After four passages in culture it was determined L7™ hPSC Culture System is a robust xeno-free and defined system that allows for efficient proliferation of hPSCs.



(A) Schematic representation of dissociation protocol using L7™ hPSC Passaging Solution. (B) Phase contrast images showing stages of hPSC after addition of L7™ hPSC Passaging Solution for 5 minutes (I) note disruption of hPSC colonies (II) uniform small cell aggregates after Step 2 (III) and colonies after 16 hours of seeding on a fresh L7™ hPSC Matrix Coated Plate in L7™ hPSC Medium.

See Lonza's 2014 Fall Resource Notes article (page 5-7) for additional data and full article.

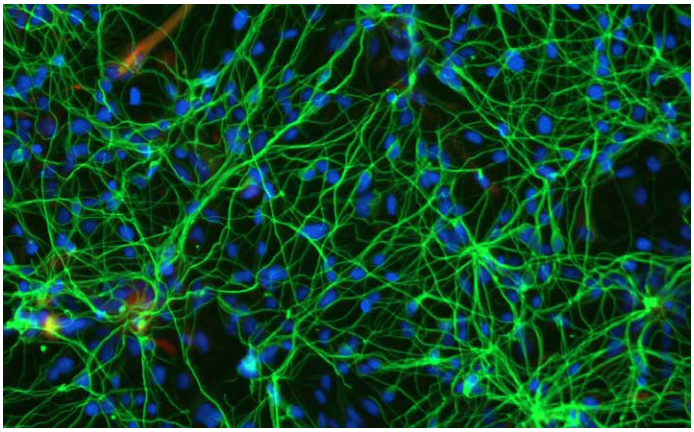
Pluripotent Stem Cells – Differentiation and Modification

Pluripotent Stem Cell-derived Cell Types

Lonza and its collaborators utilize proprietary methods for scalable production of physiologically relevant cell types from pluripotent stem cells. These highly pure cell populations specifically address issues of limited tissue availability, donor and preparation variability, and improve the predictive strength of current animal and cell based models.

Benefits

- Pure human cells; no species extrapolation necessary
- Available in large quantities
- Avoid difficult isolations, poor yields, low purity and / or lengthy differentiation processes
- Minimal lot-to-lot variation
- Ready-to-use cryopreserved vials for more flexibility in your experimentation



Standard MotorPlate™ Cells stained for Neuronal Class III β-tubulin (green) and Glial Fibrillary Acid Protein (red). Nuclei are counterstained with DAPI (blue).

Human ESC-derived Motor Neuron Progenitors

Cryopreserved MNPs – MNPs frozen down at approximately day 28 after induction of neural differentiation.

Applications

- Viability, toxicity, and neuronal outgrowth assays
- Maturation studies and functional testing
- Motor neuron disease research (ALS, SMA, etc.)

Cell Testing and Specifications

- 75% Neuronal Class III β-tubulin (TUJ1)
- 30% Neurofilament (SMI-32) – mature only
- 15% of Glial Fibrillary Acid Protein (GFAP)

Pluripotent Stem Cells – Differentiation and Modification

Genome Editing using the Nucleofector™ Technology

For genome editing, engineered nucleases are transferred into cells to delete, insert or replace a targeted genomic sequence. Those nucleases are fused or interact with sequence specific DNA binding components directing the nuclease to the target sequence.

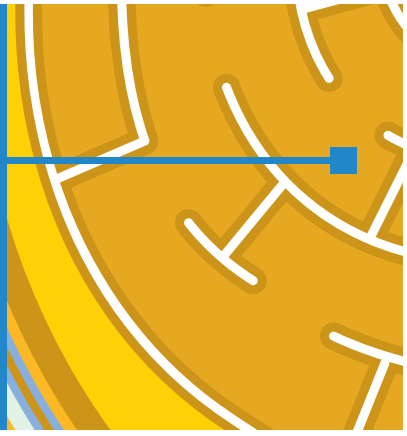
Lonza's non-viral Nucleofector™ Technology has been shown to work as a reliable and sufficient method for transferring the required DNA- or RNA-based components into various cell lines and primary or stem cells, like e.g. primary T cells, human ES or iPS cells.

Nucleofection Benefits for Genome Editing

- High transfection efficiencies for a broad range of cell types, including iPSC
- Efficient co-transfection of various substrates
- Same conditions for transfecting plasmid DNA, mRNA or PCR cassettes, ssODN
- Proven for ZFN, TALEN and CRISPR by more than 30 publications, including high ranking journals

"How can I stably modulate gene expression in pluripotent stem cells?"

SOLUTION:
Our non-viral Nucleofector™ Technology allows simple and reliable genome editing of ESC's, iPSCs or other cells using ZFN, TALEN or CRISPR/Cas9 technologies.



www.lonza.com/genome-editing – for further information

Transfection Results for Pluripotent Stem Cells

	Efficiency*	Viability*	Kit for 4D-Nucleofector™ and 96-well Shuttle™ Systems	Kit for Nucleofector™ II/2b Device
Embryonic Stem Cells, human (general)	20–78%	50–98%	P3 Primary Cell	Human Stem Cell Starter
Embryonic Stem Cells, human (H1)	22%	96%	Primary Cell Optimization	Human Stem Cell 1
Embryonic Stem Cells, human (H9)	51–57%	48–83%	Primary Cell Optimization	Human Stem Cell 2
Embryonic Stem Cells, human (H9.2)	45–78%	57–72%	Primary Cell Optimization	Human Stem Cell 1
Embryonic Stem Cells, human (Hues-9)	30–55%	50–75%	Primary Cell Optimization	Human Stem Cell 2
Embryonic Stem Cells, human (BG01V)	20–30%		Cell Line Optimization	Human Stem Cell 2
Embryonic Stem Cells, mouse (mESC)	50–90%	68–99%	P3 Primary Cell	Mouse ES
Induced Pluripotent Stem Cell, human	50–60%	50–75%	P3 or P4 Primary Cell	Human Stem Cell Starter

Cells marked blue have Lonza-validated optimized protocols.
*Approximate ranges extrapolated from larger result collections, including Lonza and customer data.

www.lonza.com/celldatabase – for further information and protocol guidance

Adult Stem Cells – Proliferation

Choose from Lonza's extensive range of isolated primary stem cells and culture them in medium optimized for growth or differentiation. Avoid costly and variable isolations. Lonza's adult stem cells are high purity and possess full differentiation capacity.

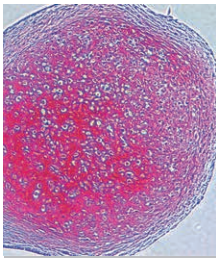
New and Improved Cell Characterization of MSCs to Support ISCT Standards.

Human Mesenchymal Stem Cells

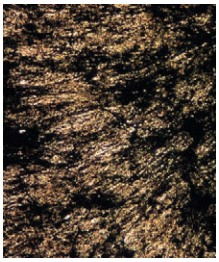
- Isolated from bone marrow
- >90% positive for CD105, CD166, CD44, CD90, CD73
- <5% negative for CD34, CD45, CD14, CD19, HLA-DR
- Tested for the ability to differentiate into osteogenic, chondrogenic, and adipogenic lineages
- Functional assays available to quantify intracellular lipid accumulation (AdipoRed™ Assay Reagent) and lipolysis of differentiated adipocytes (AdipoLyze™ Lipolysis Detection Assay)
- Functional assay to quantify *in vitro* mineralization by differentiated osteoblasts (OsteoImage™ Mineralization Assay)
- Negative for HIV-1, Hepatitis-B, and Hepatitis-C
- All cells test negative for bacterial, fungal, and mycoplasma contamination

"How can I get the full differentiation potential from my stem cells?"

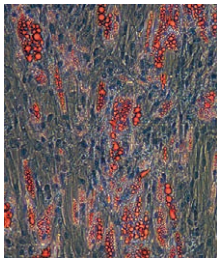
SOLUTION:
Lonza stem cells have high purity and homogeneity (confirmed by FACS analysis of positive and negative markers).



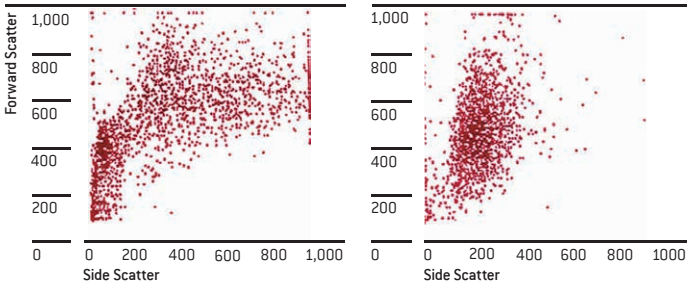
hMSC differentiated chondrocytes



hMSC differentiated osteoblasts



hMSC differentiated adipocytes



Poietics™ hMSC-human Mesenchymal Stem Cells showing a uniform profile analyzed by flow cytometry, indicating a pure population.

MSC Media Differentiation Kits are exclusively licensed by Lonza from Osiris Therapeutics, Inc. and are subject to the following limited use license:

The included biological material, including progeny and derivatives, (collectively referred to as material) is licensed to you under specific terms. You are responsible for ensuring that the terms of the license agreement are met.

Grants of license: Lonza Walkersville, Inc. grants you a non-transferable, non-exclusive license to use the material for research.

Not for human use: The material may not be used: a) in humans; b) in conjunction with human clinical trials; c) in association with human diagnostics.

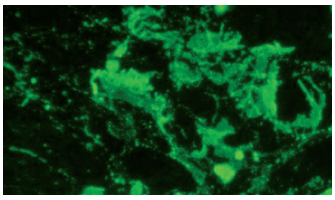
Material not transferable: You may not transfer the material to any other person or organization.

Patent notice: Material under license from Osiris Therapeutics, Inc. Material is covered by US patent 5,486,359 and others.

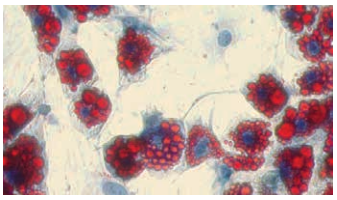
Adult Stem Cells – Proliferation

Rat Mesenchymal Stem Cells

- Positive for CD29, CD90
- Negative for CD11b, CD34, CD45
- Tested for the ability to differentiate into osteogenic and adipogenic lineages
- All cells test negative for bacterial, fungal, and mycoplasma contamination



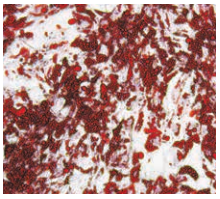
Rat MSCs stained with OsteoImage™ Assay for bone mineralization (osteogenesis)



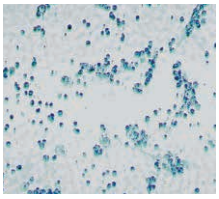
Rat MSCs differentiated into adipocytes stained with Oil Red O

Human Adipose-derived Stem Cells

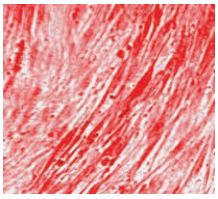
- Isolated from lipoaspirate
- Positive for CD13, CD29, CD44, CD73, CD90, CD105, CD166
- Negative for CD14, CD31, CD45, HIV-1, Hepatitis-B, and Hepatitis-C
- Functional assays available to quantify intracellular lipid accumulation (AdipoRed™ Assay Reagent) and lipolysis of differentiated adipocytes (AdipoLyze™ Lipolysis Detection Assay)
- All cells test negative for bacterial, fungal, and mycoplasma contamination



ADSC – derived adipocytes stained with Oil Red O



ADSC – chondrocytes stained with Alcian Blue



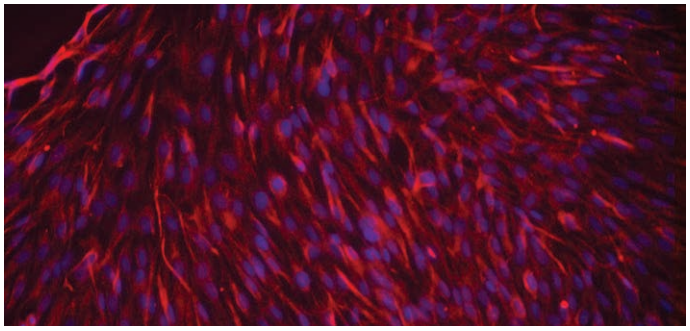
ADSC – derived osteoblasts stained with Alizarin Red

Human CD34⁺ Cells

- Isolated from bone marrow and cord blood
- Isolated from mononuclear cells using positive immunomagnetic selection
- Cell purity is > 90% via FACS
- Negative for HIV-1, Hepatitis-B, and Hepatitis-C
- All cells test negative for bacterial, fungal, and mycoplasma contamination

HPGM™ Hematopoietic Growth Medium

A chemically defined, serum-free, xeno-free media developed to support (with the addition of appropriate cytokines) the proliferation and differentiation of CD34⁺ hematopoietic stem cells (HSC) and hematopoietic progenitor cells (HPC). HPGM™ Hematopoietic Growth Medium does not contain any exogenous growth factors, artificial stimulators of cellular proliferation, or undefined supplements.



Dental pulp stem cells stained for dentin sialophosphoprotein (DSPP) (red) and DAPI (blue)

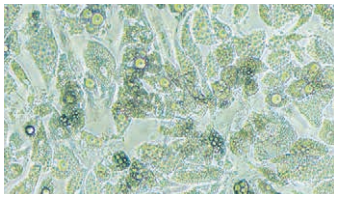
Human Dental Pulp Stem Cells

- Poietics™ Human Dental Pulp Stem Cells are mesenchymal like stem cells harvested from human teeth
- Isolated adult third molars
- Positive for CD105, CD166, CD29, CD90, CD73
- Negative for CD133, CD34, CD45
- Cell purity is > 90% via flow cytometry
- Negative for HIV-1, Hepatitis-B, and Hepatitis-C
- All cells test negative for bacterial, fungal, and mycoplasma contamination

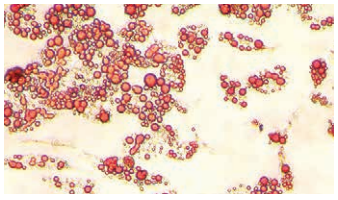
Adult Stem Cells – Proliferation

Preadipocytes

- Poietics™ Subcutaneous Preadipocytes are precursor cells, isolated from subcutaneous fat, that develop into adipocytes when fully differentiated and are characterized by the accumulation of intracellular triglycerides
- Poietics™ Human Visceral Preadipocytes are precursor cells, isolated from visceral, abdominal tissue (kidney and bladder), that develop into adipocytes when fully differentiated and are characterized by the accumulation of intracellular triglycerides
- Characterized morphologically at day 10, using AdipoRed™ Assay
- Negative for HIV-1, Hepatitis-B, and Hepatitis-C
- All cells test negative for bacterial, fungal, and mycoplasma contamination



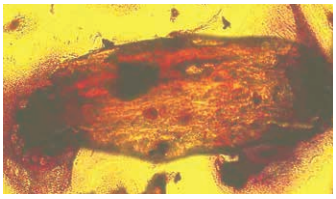
Differentiated subcutaneous preadipocyte cells



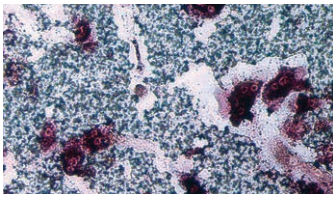
Differentiated visceral preadipocyte cells stained with oil red O

Osteoclast Precursors

- Characterized morphologically at day 7 as large, multi-nucleated cells
- Differentiated cells stain positive for tartrate-resistant acid phosphatase (TRAP)
- Functional assay to quantify *in vitro* bone resorption by differentiated osteoclasts (OsteoLyse™ Assay Kit, CalciFluor™ Bone Resorption Assay, OsteoAssay™ Human Bone Plate)
- Negative for HIV-1, Hepatitis-B, and Hepatitis-C
- All cells test negative for bacterial, fungal, and mycoplasma contamination



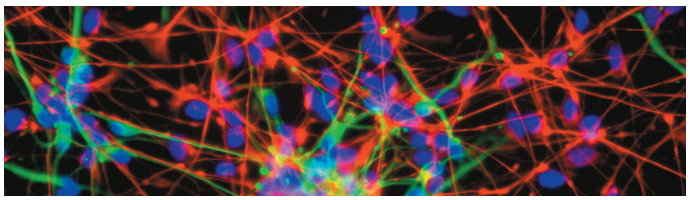
Differentiated human osteoclasts resorbing bone fragment



Pits formed from bone resorption activity of differentiated osteoclasts

Neural Progenitors

- Neurospheres differentiate into a mixed population of neurons and astrocytes
- Following adhesion to laminin in the presence of brain-derived neurotrophic factor (BDNF, 25 ng/mL), differentiated NHNP stain positive for beta tubulin III, specific for neuronal lineage, and Glial Fibrillary Acidic Protein (GFAP), denoting astrocyte lineage.
- Negative for HIV-1, Hepatitis-B, and Hepatitis-C
- All cells test negative for bacterial, fungal, and mycoplasma contamination



NHNP stained for ß-tubulin III and GFAP

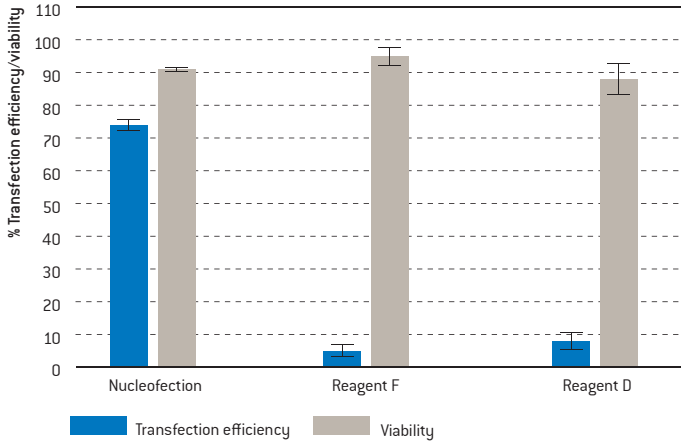
Adult Stem Cells – Differentiation and Modification

Nucleofector™ Technology for Transfection of Adult Stem Cells

Nucleofector™ Technology is the efficient non-viral transfection method for pluripotent and adult stem cells, as well as their differentiated progenitors. Suited for almost any substrate, Nucleofection enables efficient transfection without altering the biochemical functionality of the transfected cell.

- Optimized transfection protocols for a variety of stem and progenitor cells
- Preserved cellular functionality and reduced toxicity, maintaining differentiation potential
- Different device platforms supporting broad spectrum of cell numbers and throughput

Comparison of Nucleofection with Lipofection for Transfection of Human MSC



MSC were transfected by Nucleofection with pcDNA3/NT-GFP using either Nucleofection or the lipid-based. MSC transfected by Nucleofection were analyzed for transfection efficiency roughly 60 hours post Nucleofection, cells transfected with lipid reagents were analyzed after 72 hours. Transfection efficiency was scored by flow cytometric analysis and reported as percentage of GFP⁺ cells. The percentage of viable cells was estimated by trypan blue exclusion. (Data courtesy of Aluigi M, Fogli M, Curti A, Isidori A, Gruppioni E, Chiodoni C, Colombo MP, Versura P, D'Errico-Grigioni A, Ferri E, Baccarani M and Lemoli RM, Institute of Hematology and Medical Oncology, Bologne, Italy).

Transfection Results for Pluripotent Stem Cells

	Efficiency*	Viability*	Kit for 4D-Nucleofector™ and 96-well Shuttle™ Systems	Kit for Nucleofector™ II/2b Device
Primary Cells				
Adipose-derived stem cells, human (ADSC)	73–94%	58–85%	P1 Primary Cell	Human MSC
CD34⁺ cells, human	83%	62–70%	P3 Primary Cell	Human CD34
Mesenchymal stem cells, human (hMSC)	40–88%	50–86%	P3 Primary Cell	Human MSC
Preadipocytes, subcutaneous, human	31–84%	33–95%	P1 Primary Cell	Basic Fibroblast
Preadipocytes, visceral, human	28–94%	35–90%	P1 Primary Cell	Basic Fibroblast
Neural precursor, cow	62–65%	73–75%	Primary Cell Optimization	Basic Neuron
Neural stem cell, human (hNSC)	90%		Primary Cell Optimization	Mouse NSC
Neural stem cell, mouse (mNSC)	60–82%	80%	P4 Primary Cell	Mouse NSC
Neural stem cell, rat (rNSC)	42–46%		Primary Cell Optimization	Rat NSC
Oligodendrocyte precursors, rat	17%	90%	P3 Primary Cell	Basic Glial Cell

Cells marked blue have Lonza-validated optimized protocols.
*Approximate ranges extrapolated from larger result collections, including Lonza and customer data.

www.lonza.com/celldatabase – for further information and protocol guidance

Cell Analysis Tools – Live Cell Imaging

CytoSMART™ System

Your Stem Cell Culture is Just One Click Away

Monitor your stem cell culture anytime using our new CytoSMART™ System – your personal live cell imaging device. The System consists of a mini-microscope, the CytoSMART™ Device, that is linked to an accompanying tablet outside the incubator. Via this tablet you start your CytoSMART™ Projects and capture the images of your cell culture in defined intervals. All images are transmitted to the CytoSMART™ Connect Cloud via wireless transmission (Wifi), meaning, you can monitor your cell culture remotely and in real-time with any browser-capable device, be it your smartphone, tablet or PC.

The Smarter Way for Stem Cell Cultures

With the CytoSMART™ System your cells can remain in their defined conditions in the incubator while you monitor the stem cell culture online.

- Easy documentation and video-taping of your stem cell culture, e.g. for generation of iPSC
- Remote monitoring of stem cell cultures grown under hypoxic conditions or under GMP condition
- Cell culture standardization through operator independent determination of confluency with automatic alerts for cell culture functionality
- Easy and immediate download of cell culture images or videos from CytoSMART™ Connect Cloud

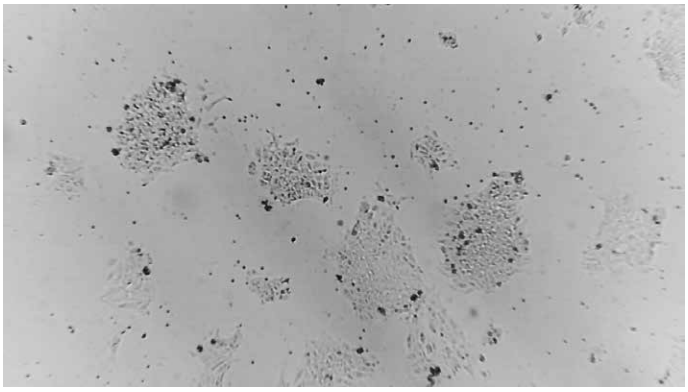


Image of iPSC culture maintained in L7™ System using CytoSMART™ Lux 10X System. Please refer to our website to view a video of an iPSC culture taken with the CytoSMART™ System.

www.lonza.com/cytosmart

Cell Analysis Tools – Assays

Utilize Lonza's research tools for every step of your workflow. Lonza provides everything you need for biologically relevant results – from culture media and sample preparation, all the way through protein confirmation.

AdipoLyze™ Lipolysis Detection Assay

The AdipoLyze™ Lipolysis Detection Assay is a fast, sensitive, fluorescent in vitro assay used for detecting small quantities of glycerol in cells undergoing lipolysis.

AdipoRed™ Assay Reagent

The AdipoRed™ Assay Reagent is designed for assessing the effect of compounds on the differentiation of preadipocytes or on lipid utilization in mature adipocytes. This objective, high-throughput, homogeneous fluorescence-based assay quantifies the accumulation of intracellular triglycerides and provides significant advantages to drug discovery efforts.

ToxiLight™ Kit

Check a compound's cytotoxic effects non-destructively by measuring adenylate kinase (AK) leakage from damaged cells.

ViaLight™ Plus Kit

For a fast, sensitive and safe measurement of cytotoxicity and cell proliferation.

MycoAlert™ Mycoplasma Detection Assay

The MycoAlert™ Assay Kit is a selective biochemical test that exploits the activity of specific mycoplasmal enzymes which are found in all 6 of the main mycoplasma cell culture contaminants and the vast majority of 180 species of mycoplasma.

OsteoAssay™ Human Bone Plate

The OsteoAssay™ Plate provides a thin layer of adherent real human bone for the culture of primary human or non-human osteoclasts, osteoclast precursors, or immortalized cell lines. Cells can be stained with standard cytochemical or immunofluorescent techniques. Assays of bone resorption and osteoclast precursor differentiation can be performed easily by sampling the cell culture supernatant.

OsteoImage™ Mineralization Assay

The OsteoImage™ Mineralization Assay is a rapid, fluorescent in vitro assay for assessing bone cell mineralization. The OsteoImage™ Assay can quantitate in vitro mineralization by osteogenic stem cells, primary osteoblasts, and osteoblast-like cell lines. It is based on specific binding of the fluorescent OsteoImage™ Staining Reagent to the hydroxyapatite portion of bone-like nodules deposited by cells. Unlike typical histochemical methods such as von Kossa and Alizarin red, neither of which is hydroxyapatite specific, the OsteoImage™ Assay eliminates multiple steps or tedious extraction steps.

OsteoLyse™ Assay Kit

The OsteoLyse™ Assay Kit provides an easy to use protocol for quantitatively measuring in vitro osteoclast-mediated bone resorption in a high-throughput format. Osteoclasts can be seeded onto the OsteoLyse™ Plate using traditional cell culture protocols. The assay directly measures the release of Europium-labeled collagen fragments into the osteoclast cell culture supernatant via time resolved fluorescence, indicating their resorption activity levels.

Cell Analysis Tools – Electrophoresis

Molecular Biology Products

Nucleic Acid Electrophoresis
– FlashGel™ System

Protein Electrophoresis
– PAGEr™ EX Gels
– ProSieve™ EX Reagents

Lonza's molecular biology products offer basic aspects of cancer research. Speed up your results from PCR analysis, RNA integrity analysis, to fragment isolation for cloning. Lonza's FlashGel™ System can get you there in minutes. For protein analysis and western blotting Lonza's PAGEr™ EX Gels and ProSieve™ EX Reagents help speed your research from hours to minutes.

Custom Research Solutions

If you're looking for customized research solutions or expert support services, just ask your local Lonza representative. They can put you in touch with experts who have decades of experience in cell isolation, transfection, and testing services.

Custom Cell Services

You can order virtually any human or animal cell through our vast tissue network. Lonza's isolation experts can provide you with:
– A broad range of cells, packaged to your specifications
– Customized treatments, such as cell pelleting, personalized media, and specific treatment prior to cryopreservation

Scientific Support

For advice or information on any Lonza product, just contact our scientific support team. They offer:
– More than 50 years of combined troubleshooting experience
– Educational webinars
– Real disease research application data

You can find contact details for your regional support team on the back of this brochure.

Ordering Information: Primary Cells and Media

Cat. No.	Product Name	Size
L7™ hiPSC Reprogramming and hPSC Culture System		
L7™ hPSC Culture System		
FP-5013	L7™ hPSC Passaging Solution	100 mL
FP-5002	L7™ hPSC Cryosolution	50 mL
FP-5020	L7™ hPSC Matrix	1 mg
FP-5007	L7™ hPSC Medium	500 mL basal medium + 5 mL supplement
L7™ PBMC Reprogramming Bundle		
FP-5124	L7™ PBMC Priming-Recovery Kit, contains: L7™ PBMC Priming-Recovery Basal Medium and L7™ PBMC Reprogramming Enhancers A and B	24 rxn
CC-2702	hPBMCs – Human Peripheral Blood Mononuclear Cells	≥ 50 million cells
V4XP-3024	P3 Primary Cell 4D-Nucleofector™ Kit	24 rxn (100 µl Nucleocuvette™)
Adult Stem Cells and Media		
Human Mesenchymal Stem Cells		
PT-2501	hMSC – Human Mesenchymal Stem Cells, cryopreserved	≥750,000 cells
PT-3001	MSCGM™ Mesenchymal Stem Cell Growth Medium BulletKit™, contains 1 ea. PT-3238 and PT-4105	Kit
PT-3002	hMSC – Human Mesenchymal Stem Cell Osteogenic Differentiation Medium BulletKit™, contains 1 ea. PT-3924 and PT-4120	Kit
PT-3003	hMSC – Human Mesenchymal Stem Cell Chondrogenic Differentiation Medium BulletKit™, contains 1 ea. PT-3925 and PT-4121	Kit
PT-3004	hMSC – Human Mesenchymal Stem Cell Adipogenic Differentiation Medium BulletKit™, contains 1 ea. PT3102B, 3102A, 4122 and 4135	Kit
PT-3238	MSCBM™ – Mesenchymal Stem Cell Basal Medium	440 mL
PT-4105	MSCGM™ Mesenchymal Stem Cell Growth Medium SingleQuots™ Supplements and Growth Factors	Kit
PT-4124	rhTGF-β3 for hMSC Chondrogenic Differentiation Medium Supplement	2 µg
190620	MSCGM™ CD Mesenchymal Stem Cell Basal Medium	500 mL
190632	MSCGM™ CD Mesenchymal Stem Cell Growth Medium BulletKit™, chemically defined, with L-glutamine, without phenol red and antibiotics	Kit
192125	MSCGM™ CD Mesenchymal Stem Cell Growth Medium SingleQuots™, supplements and growth factors	Kit
Human Adipose-Derived Stem Cells		
PT-3273	ADSC – Apidose-Derived Stem Cells Basal Medium	500 mL
PT-4503	ADSC – Apidose-Derived Stem Cells Growth Medium SingleQuots™ Supplements and Growth Factors	Kit
PT-4505	ADSC – Apidose-Derived Stem Cells Growth Medium BulletKit™, includes PT-4503 and PT-3273	Kit
PT-5006	Human Adipose-Derived Stem Cells	≥1 million cells
PT-5007	D-HADSC – Diseased Human Adipose-derived Stem Cells – Diabetes Type I	≥1 million cells
PT-5008	D-HADSC – Diseased Human Adipose-derived Stem Cells – Diabetes Type II	≥1 million cells
Human Dental Pulp Stem Cells		
PT-5025	hDPSC – Human Dental Pulp Stem Cells	≥1 million cells
PT-3927	DPSC – Dental Pulp Stem Cell Basal Medium	500 mL
PT-4516	DPSC – Dental Pulp Stem Cell SingleQuots™ Supplements and Growth Factors	Kit
PT-3005	DPSC – Dental Pulp Stem Cell BulletKit™ Medium	Kit
Rat Mesenchymal Stem Cells		
PT-2505	R-MSC – Rat Mesenchymal Stem Cells	≥750,000 cells
192853	Rat MSCGM™ Mesenchymal Stem Cell Growth Medium BulletKit™	Kit
192855	rMSC – Rat Mesenchymal Stem Cell Adipogenic Differentiation BulletKit™	Kit

Ordering Information: Primary Cells and Media

Cat. No.	Product Name	Size
Progenitor Precursor Cells and Media		
Human CD34⁺ Cells		
1M-101	Human Bone Marrow CD34⁺ Progenitor Cells, fresh	≥100,000 cells
1M-101A	Human Bone Marrow CD34⁺ Progenitor Cells, fresh	≥300,000 cells
1M-101B	Human Bone Marrow CD34⁺ Progenitor Cells, fresh	≥500,000 cells
1M-101C	Human Bone Marrow CD34⁺ Progenitor Cells, fresh	≥1 million cells
2M-101	Human Bone Marrow CD34⁺ Progenitor Cells, cryopreserved	≥100,000 cells
2M-101A	Human Bone Marrow CD34⁺ Progenitor Cells, cryopreserved	≥300,000 cells
2M-101B	Human Bone Marrow CD34⁺ Progenitor Cells, cryopreserved	≥500,000 cells
2M-101C	Human Bone Marrow CD34⁺ Progenitor Cells, volume discount available	≥1 million cells
2M-101D	Human Bone Marrow CD34⁺ Progenitor Cells, cryopreserved	≥2 million cells
2M-101F	Human Bone Marrow CD34⁺ Progenitor Cells, cryopreserved	≥10 million cells
2C-101	Human Cord Blood CD34⁺ Progenitor Cells, cryopreserved	≥1 million cells
2C-101A	Human Cord Blood CD34⁺ Progenitor Cells, cryopreserved	≥500,000 cells
2C-101B	Human Cord Blood CD34⁺ Progenitor Cells	≥100,000 cells
PT-3926	HPGM™ Hematopoietic Progenitor Growth Medium	500 mL
Human Preadipocyte Cells		
PT-5001	Human Subcutaneous Preadipocyte Cells, cryopreserved	≥4 million cells
PT-5005	Human Visceral Preadipocyte Cells, cryopreserved	≥1 million cells
PT-5020	Human Subcutaneous Preadipocyte Cells, cryopreserved	≥1 million cells
PT-5021	Diseased Human Subcutaneous Preadipocyte Cells, Diabetes Type I, cryopreserved	≥1 million cells
PT-5022	Diseased Human Subcutaneous Preadipocyte Cells, Diabetes Type II, cryopreserved	≥1 million cells
PT-5023	Diseased Human Visceral Preadipocyte Cells, Diabetes Type I, cryopreserved	≥1 million cells
PT-5024	Diseased Human Visceral Preadipocyte Cells, Diabetes Type II, cryopreserved	≥1 million cells
PT-8002	PGM™ 2 Preadipocyte Growth Medium-2 BulletKit™, contains 1 ea. PT-8202, PT-9502	Kit
PT-8202	PBM™ 2 Preadipocyte Basal Medium-2	500 mL
PT-9502	PGM™ 2 Preadipocyte Growth Medium-2 SingleQuots™ Supplements and Growth Factors	Kit
Human Osteoclast Precursor Cells		
2T-110	hOPC – Human Osteoclast Precursor Cells, cryopreserved	≥1 million cells
PT-8001	OCP – Osteoclast Precursor Medium BulletKit™, contains 1 ea. PT-8201 and PT-9501	Kit
PT-8201	OCP – Osteoclast Precursor Basal Medium	100 mL
PT-9501	OCP – Osteoclast Precursor Medium SingleQuots™ Supplements and Growth Factors	Kit
Human Neural Progenitor Cells		
PT-2599	NHNP – Human Neural Progenitor Cells	≥1.2 million cells
CC-3209	NPMM™ Neural Progenitor Maintenance Medium BulletKit™, contains 1 ea. CC-3210, CC-4241 and CC-4242	Kit
CC-3210	NPBM™ Neural Progenitor Basal Medium	200 mL
CC-3229	NPDM™ Neural Progenitor Differentiation Medium BulletKit™, contains 1 ea. CC-3210 and CC-4242	Kit
CC-4241	NPMM™ Neural Progenitor Maintenance Medium SingleQuots™ Supplements and Growth Factors	Kit
CC-4242	Neural Progenitor Supplement SingleQuots™ Supplements and Growth Factors	Kit

Continued on next page

Ordering Information: Transfection

Choose the Nucleofection Platform that Suits Your Research Needs

	Advanced Platform	96-well Add-on	High-throughput Platform	Basic Device
Device	4D-Nucleofector™ System	96-Well Shuttle™ System	384-Well Nucleofector™ System	Nucleofector™ 2b Device
Unit				
Throughput (samples per run)	Low to medium (1–16)	Low to high (1–96)	High (384)	Low (1)
Reaction volume	20 µL + 100 µL	20 µL	20 µL	100 µL
Electrode material	Conductive polymer	Conductive polymer	Conductive polymer	Aluminum
Low cell numbers (20 µL)	5×10^4 to 5×10^5	5×10^4 to 5×10^5	5×10^4 to 5×10^5	–
High cell numbers (100 µL)	$4–5 \times 10^6$	■	■	$4–5 \times 10^6$
DNA vector amount/sample	0.2–1 µg (20 µL) 1–5 µg (100 µL)	0.2–1 µg	0.2–1 µg	1–5 µg
siRNA amount/sample (concentration 2 nM – 2 µM)	0.04–40 pmol (20 µL) 0.2–200 pmol (100 µL)	0.04–40 pmol	0.04–40 pmol	0.2–200 pmol
Adherent Nucleofection	■	–	–	–
Compatibility with 96-well Shuttle™ System	■	–	–	–

Cat. No.	Product Name	Size
Nucleofector™ Devices		
AAB-1001	Nucleofector™ 2b Device	Device
AAF-1001B	4D-Nucleofector™ Core Unit	Device
AAF-1001X	4D-Nucleofector™ X Unit	Device
AAM-1001S	96-well Shuttle™ Device	Device
Kits for 4D-Nucleofector™ Device		
V4XP-1012	P1 Primary Cell 4D-Nucleofector™ X Kit L	12 rxn (100 µL Nucleocuvette™)
V4XP-1024		24 rxn (100 µL Nucleocuvette™)
V4XP-1032	P1 Primary Cell 4D-Nucleofector™ X Kit S	32 rxn (20 µL Nucleocuvette™; 16-well)
V4XP-3012	P3 Primary Cell 4D-Nucleofector™ X Kit L	12 rxn (100 µL Nucleocuvette™)
V4XP-3024		24 rxn (100 µL Nucleocuvette™)
V4XP-3032	P3 Primary Cell 4D-Nucleofector™ X Kit S	32 rxn (20 µL Nucleocuvette™; 16-well)
V4XP-4012	P4 Primary Cell 4D-Nucleofector™ X Kit L	12 rxn (100 µL Nucleocuvette™)
V4XP-4024	P4 Primary Cell 4D-Nucleofector™ X Kit L	24 rxn (100 µL Nucleocuvette™)
V4XP-4032	P4 Primary Cell 4D-Nucleofector™ X Kit S	32 rxn (20 µL Nucleocuvette™; 16-well)
V4XP-9096	Primary Cell Optimization 4D-Nucleofector™ X Kit	96 rxn (20 µL Nucleocuvette™; 16-well)
Kits for 96-well Nucleofector™ Device		
V4SP-1096	P1 Primary Cell 96-well Nucleofector™ Kit	96 rxn (20 µL Nucleocuvette™)
V4SP-1960		960 rxn (20 µL Nucleocuvette™)
V4SP-3096	P3 Primary Cell 96-well Nucleofector™ Kit	96 rxn (20 µL Nucleocuvette™)
V4SP-3960		960 rxn (20 µL Nucleocuvette™)
V4SP-4096	P4 Primary Cell 96-well Nucleofector™ Kit	96 rxn (20 µL Nucleocuvette™)
V4SP-4960		960 rxn (20 µL Nucleocuvette™)
V4SP-9096	Primary Cell Optimization 96-well Nucleofector™ Kit	160 rxn (20 µL Nucleocuvette™)

Ordering Information: Transfection

Cat. No.	Product Name	Size
Kits for Nucleofector™ II/2b Device		
VACA-1003	Cell Line Nucleofector™ Kit V	10 rxn (100 µL Aluminium cuvette)
VCA-1003		25 rxn (100 µL Aluminium cuvette)
VVCA-1003		100 rxn (100 µL Aluminium cuvette)
VAPA-1003	Human CD34+ Cell Nucleofector™ Kit	10 rxn (100 µL Aluminium cuvette)
VPA-1003		25 rxn (100 µL Aluminium cuvette)
VVPA-1003		100 rxn (100 µL Aluminium cuvette)
VAPG-1004	Mouse Neural Stem Cell Nucleofector™ Kit	10 rxn (100 µL Aluminium cuvette)
VPG-1004		25 rxn (100 µL Aluminium cuvette)
VVPG-1004		100 rxn (100 µL Aluminium cuvette)
VAPG-1005	Rat Neural Stem Cell Nucleofector™ Kit	10 rxn (100 µL Aluminium cuvette)
VPG-1005		25 rxn (100 µL Aluminium cuvette)
VVPG-1005		100 rxn (100 µL Aluminium cuvette)
VAPE-1001	Human Mesenchymal Stem Cell Nucleofector™ Kit	10 rxn (100 µL Aluminium cuvette)
VPE-1001		25 rxn (100 µL Aluminium cuvette)
VVPE-1001		100 rxn (100 µL Aluminium cuvette)
VAPH-1001	Mouse Embryonic Stem Cell Nucleofector™ Kit	10 rxn (100 µL Aluminium cuvette)
VPH-1001		25 rxn (100 µL Aluminium cuvette)
VVPH-1001		100 rxn (100 µL Aluminium cuvette)
VPH-5002	Human Stem Cell Nucleofector™ Starter Kit	18 rxn (100 µL Aluminium cuvette)
VAPH-5012	Human Stem Cell Nucleofector™ Kit 1	10 rxn (100 µL Aluminium cuvette)
VPH-5012		25 rxn (100 µL Aluminium cuvette)
VVPH-5012		100 rxn (100 µL Aluminium cuvette)
VAPH-5022	Human Stem Cell Nucleofector™ Kit 2	10 rxn (100 µL Aluminium cuvette)
VPH-5022		25 rxn (100 µL Aluminium cuvette)
VVPH-5022		100 rxn (100 µL Aluminium cuvette)
VAPI-1002	Basic Nucleofector™ Kit for Primary Mammalian Neurons (for cow neural progenitors)	10 rxn (100 µL Aluminium cuvette)
VPI-1002		25 rxn (100 µL Aluminium cuvette)
VVPI-1002		100 rxn (100 µL Aluminium cuvette)
VAPI-1003	Basic Nucleofector™ Kit for Primary Mammalian Neurons (for cow neural progenitors)	10 rxn (100 µL Aluminium cuvette)
VPI-1003		25 rxn (100 µL Aluminium cuvette)
VVPI-1003		100 rxn (100 µL Aluminium cuvette)

Ordering Information: Cell Analysis

Cat. No.	Product Name	Size
Cell Analysis		
BioAssays for Cell Proliferation and Cytotoxicity		
LT07-117	ToxiLight™ Non-Destructive Cytotoxicity BioAssay Kit	1,000 tests
LT07-121	ViaLight™ Plus Cell Proliferation and Cytotoxicity BioAssay Kit	1,000 tests
LT07-122	ViaLight™ MDA Plus Microbial Proliferation and Cytotoxicity BioAssay Kit	1,000 tests
LT07-217	ToxiLight™ Non-Destructive Cytotoxicity BioAssay Kit	500 tests
LT07-221	ViaLight™ Plus Cell Proliferation and Cytotoxicity BioAssay Kit	500 tests
LT07-321	ViaLight™ Plus Cell Proliferation and Cytotoxicity BioAssay Kit	10,000 tests
LT07-517	ToxiLight™ 100% Lysis Control Set	10 mL, 200 tests (sold separately)
LT17-217	ToxiLight™ Non-Destructive Cytotoxicity BioAssay Kit, with plates	500 tests
LT17-221	ViaLight™ Plus Cell Proliferation and Cytotoxicity BioAssay Kit, with plates	500 tests
BioAssays for Cell Function		
193339	AdipoLyze™ Lipolysis Detection Assay	96 tests
PA-1000	OsteoAssay™ Human Bone Plate	96-well plate
PA-1500	OsteoLyse™ Assay Kit, human collagen	96 tests
PA-1503	OsteoImage™ Mineralization Assay	480 tests
PT-7009	AdipoRed™ Assay Reagent	5 × 4.0 ml
CytoSMART™ System		
AACS-1002	CytoSmart™ Lux 10X System	Device

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www.lonza.com/stemcells

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