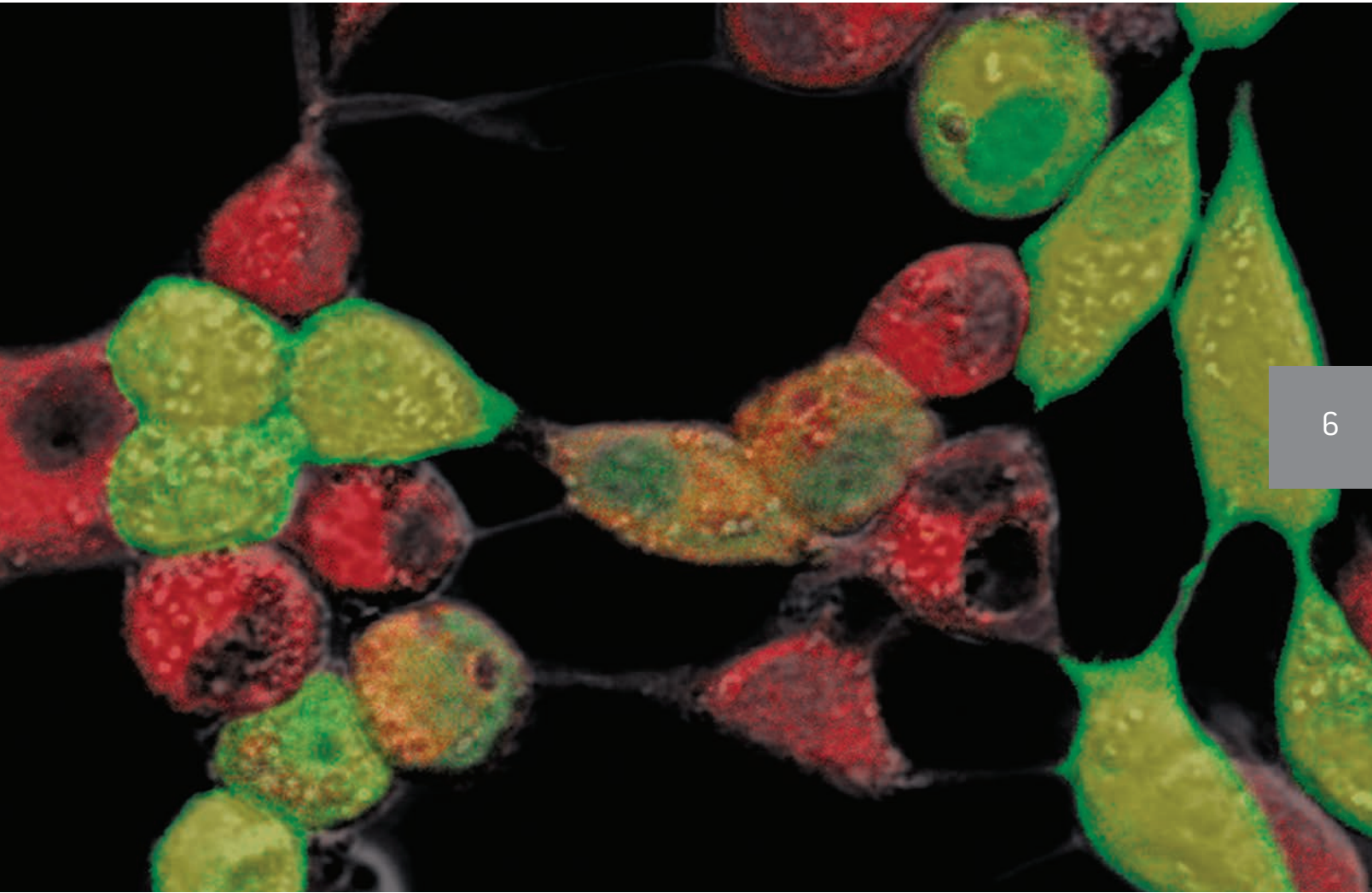




# 6 Transfection



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# Transfection

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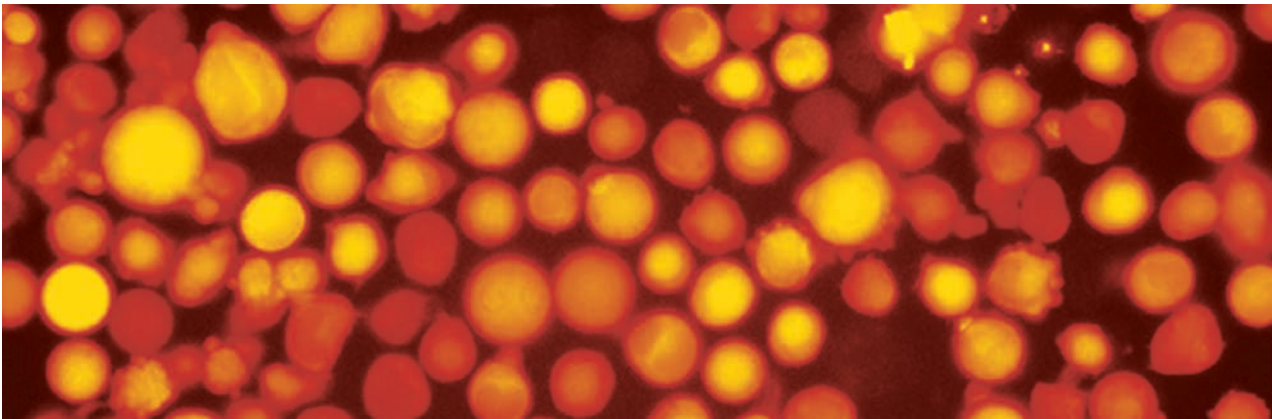
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# Nucleofector™ Technology



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## Introduction

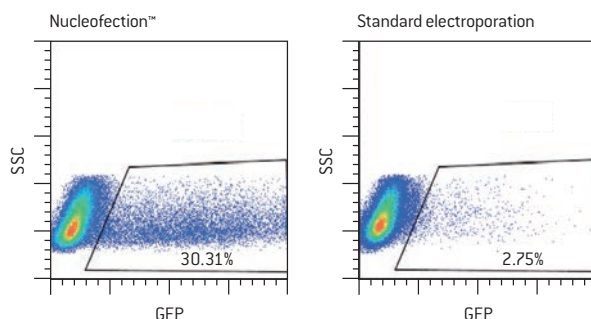
The application of systems biology and multidisciplinary approaches require that cells and model systems display *in vivo* like cellular functionality. This means that the future of cell transfection is in using primary cell types, and that transfecting these physiologically relevant cell types is typically a very difficult task using traditional methods. Additionally, when using relevant cell lines as model systems, the critical issues are to achieve reproducibly efficient transfection with high levels of viability while matching throughput capability with the number of transfections required at each project phase – from proof of concept, through to scale-up and screening-like approaches. With the **Nucleofector™ Technology** primary cells and stem cells, as well as cell lines, can be consistently transfected at high efficiency.

Developed in 1998, the Nucleofector™ Technology was introduced to the research market in 2001 as the first efficient non-viral transfection method for primary cells and hard-to-transfect cell lines. Since then the technology has evolved through constant innovation.

### The Principle

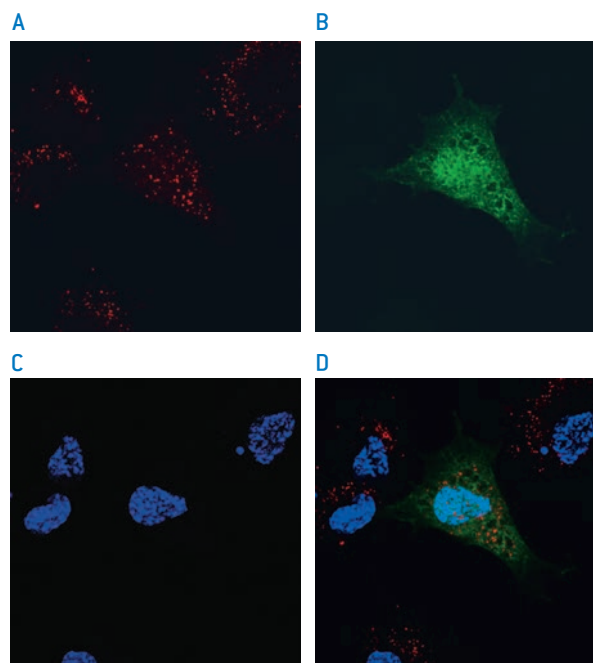
Nucleofection is a technology based on the momentary creation of small pores in cell membranes by applying an electrical pulse. The comprehensive way in which Nucleofector™ Programs and cell-type specific solutions are developed enables nucleic acid substrate delivery not only to the cytoplasm, but also through the nuclear membrane and into the nucleus. This allows for high transfection efficiencies up to 99% and makes the transfection success independent from cell proliferation.

### Nucleofector™ Technology – the Superior Non-viral Method



**Nucleofector™ Technology – the superior non-viral method.** Transfection of the human natural killer cell line NKL using traditional electroporation and Nucleofection.  $5 \times 10^6$  NKL cells were transfected with 2.5  $\mu$ g of pmaxGFP™ Vector. Nucleofection: Nucleofector™ Solution V; Program 0-017. Standard electroporation: 25 mV, 96  $\mu$ F. Transfection efficiency was monitored by flow cytometry after 24 hours. Cells transfected by Nucleofection show a significantly better transfection efficiency compared to cells transfected by traditional electroporation. Cell viability, as measured 18 hours after transfection was also superior using Nucleofection. [Data courtesy of Dr. John Coligan, Laboratory of Immunogenetics, NIH/NIAD, Rockville, MD, USA. *J Immunol Methods* (2004) 284: 133-140.]

### DNA Delivery Straight Into the Nucleus



**DNA delivery straight into the nucleus.** Normal human dermal fibroblasts (neonatal) were transfected with 2.5  $\mu$ g  $^{32}$ P-labeled plasmid DNA encoding eGFP. After 2 hours, cells were fixed with 3.5% PFA and analyzed by confocal microscopy.  $^{32}$ P label is shown in [A], GFP fluorescence in [B], DAPI nuclear staining in [C] and a merge of all 3 fluorescent labels in [D].

## Introduction

Continued

### What Benefits are Important for Your Work?

#### ■ Superior transfection performance?

- Electrical parameters are optimized to gain high transfection efficiency and retain highest viability
- Excellent preservation of the physiological status of transfected cells

#### ■ Easy-to-use technology?

- More than 650 cell-type specific protocols lead to direct transfection success with a multitude of different cell types
- Easy optimization protocols for cell lines and primary cells allow for quick and streamlined optimization of virtually any cell type
- Dedicated White Papers support numerous applications, such as siRNA transfection and transfection of neurons
- Excellent technical and applicative support?

#### ■ Highly-skilled Scientific Support Team to assist you in your research

- Scientific Support Team members have a masters or PhD level education in biology, biochemistry or biotechnology
- Many of them with over 10 years experience in transfection support

#### ■ Proven and innovative technology?

- More than 4000 peer-reviewed publications and thousands of systems placed worldwide

#### ■ Modularity of the 4D-Nucleofector™ System allows easy adaptation to new applications

- Invention of Nucleofection of cells in adherence
- Using various cell numbers for different applications?
- Nucleofection of  $2 \times 10^4$  to  $2 \times 10^7$  cells is feasible within one single device
- Transferability of protocol conditions from small to larger cell numbers with the new 4D-Nucleofector™ System

#### ■ Easy expansion of your research?

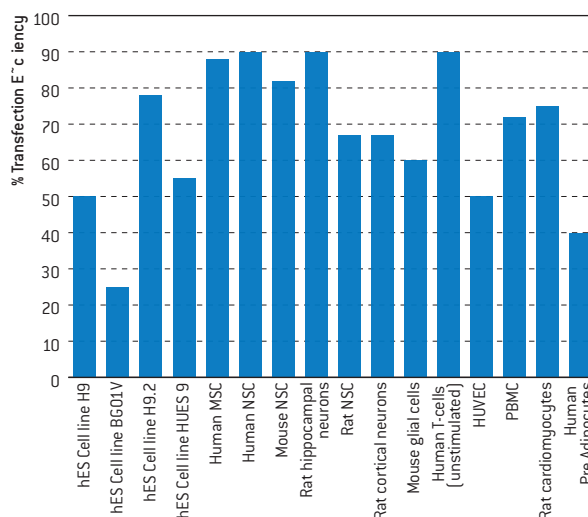
- Explore complex systems by using the same conditions to deliver DNA, RNA, oligonucleotides, PNA, peptides, or proteins
- Different device platforms fulfill your choice of sample throughput from 1 through 384 transfections per run including automated high-throughput

#### ■ Avoiding cross-contamination?

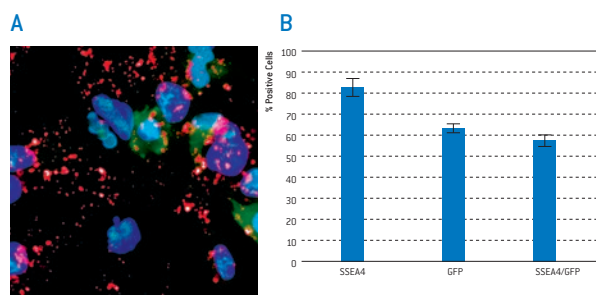
- Disposable, sterile Nucleofection Vessels minimize the risk of cross-contamination with cell or substrate leftovers

 [www.lonza.com/celldatabase](http://www.lonza.com/celldatabase)

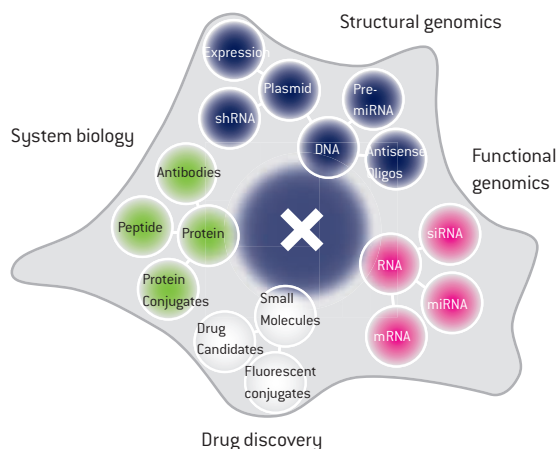
 [www.lonza.com/citations](http://www.lonza.com/citations)



Exemplary transfection efficiency data for primary cells and human stem cells.



**Conserving functionality – the first step to meaningful results.** Human H9 ES cells preserve pluripotency post Nucleofection. H9 cells were transfected by Nucleofection with the pmaxGFP™ Vector. [A] Cells analyzed after 24 hours show expression of GFP (green) as well as of the pluripotency markers SSEA4 (red) and Oct4 (purple). The blue signals refer to nuclear staining by DAPI. [B] The percentage of double-positive cells (GFP/SSEA4) was analyzed by flow cytometry. [Data kindly provided by Jennifer Moore, Rutgers University, Piscataway, USA.]



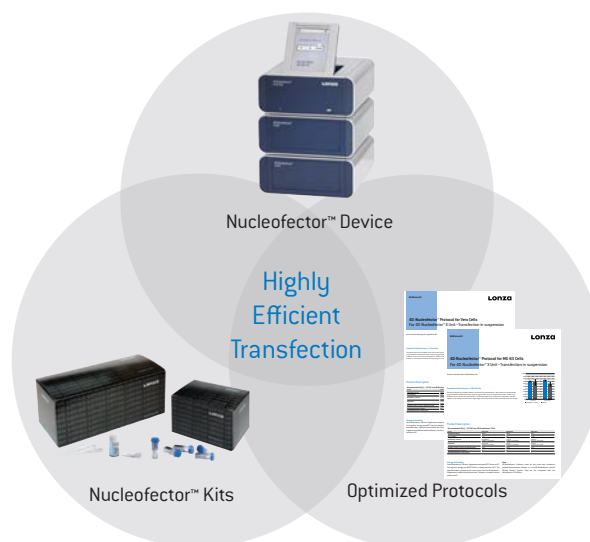
**Nucleofector™ Technology – delivers the widest range of substrates.** Overview of substrates that can be transfected into primary cells and cell lines using Nucleofection.







## Components of the Nucleofector™ Technology

The Nucleofector™ Technology relies on the combination of a Nucleofector™ Device and cell specific Nucleofector™ Kits:

- **The Nucleofector™ Device** delivers unique electrical parameters. The electrical settings are pre-programmed for each optimized cell type and can be selected via the device or PC software. We offer various device platforms (see table below), serving different needs
- **The Nucleofector™ Kits** contain a specific Nucleofector™ Solution and Supplement, specified cuvettes, pipettes, and the pmaxGFP™ Control Vector. All Nucleofector™ Solutions provide a protective environment that allows for high transfection efficiency and cell viability, while helping to maintain physiologically relevant cellular functions. A collection of Nucleofector™ Kits with optimized protocols for primary cells and cell lines is available
- Besides providing optimal Nucleofection Conditions, **Optimized Protocols** offer comprehensive guidance, including tips for cell sourcing, passage, growth conditions and media, and post transfection culture



### Overview of Nucleofection Platforms

	Advanced Platform	96-well Add-on	High-throughput Platform	Basic Device
Device	4D-Nucleofector™ System	96-well Shuttle™ Device	384-well Nucleofector™ System	Nucleofector™ 2b Device
				
Throughput (samples per run)	Low to medium (1-16)	Low to high (1-96)	High (384)	Low (1)
Reaction volume	20 µL, 100 µL, 1 mL, up to 20 mL	20 µL	20 µL	100 µL
Electrode material	Conductive polymer	Conductive polymer	Conductive polymer	Aluminum
Low cell numbers (X Unit)	$2 \times 10^4$ to $1 \times 10^6$ (20 µL)	$2 \times 10^4$ to $1 \times 10^6$	$2 \times 10^4$ to $1 \times 10^6$	–
Medium cell numbers (X Unit)	$2 \times 10^5$ to $2 \times 10^7$ (100 µL)	–	–	$2 \times 10^5$ to $2 \times 10^7$
High cell numbers (LV Unit)	$1 \times 10^7$ to $1 \times 10^8$ (1 mL) $1 \times 10^8$ to $1 \times 10^9$ (20 mL)	–	–	–
DNA Vector amount/mL sample	10 - 50 µg/mL			
siRNA amount/mL sample	2 - 2000 pmol/mL (2 nM - 2 µM)			
Adherent Nucleofection	■	–	–	–
Compatibility with 96-well Shuttle™ Device	■	–	–	–

## Advanced Platform: 4D-Nucleofector™ System


Based on user feedback, our engineers and scientists have developed the new innovative 4D-Nucleofector™ System. This system is designed for maximum flexibility and enables Nucleofection of cells in several formats combined with advanced performance and convenience. Due to its modular design the 4D-Nucleofector™ System is extremely flexible in regard to the supported applications.

The operation software allows you to design and save individual experimental setups. Additionally, a PC editor enables predefinition of experiments on a PC which can then be uploaded to the 4D-Nucleofector™ Core Unit via the integrated USB port.

### Hardware and Software Components

The 4D-Nucleofector™ System is a modular system is comprised of one **Core Unit** and the different functional units:

- **Core Unit** – Controlling the 4D-Nucleofector™ System
- **X Unit** – Supporting Nucleofection of various cell numbers in different formats
- **Y Unit** – Enabling adherent Nucleofection in 24-well culture plates
- **LV Unit** – Large-scale transfection of up to  $1 \times 10^9$  cells

 For ordering information and further details, please refer to page 190.



4D-Nucleofector™ System

### What Benefits are Important for Your Work?

#### ■ Using different cell numbers for different applications?

- Same protocol for small, medium and large scale transfection volumes
- 20  $\mu$ L Nucleocuvette™ Strip for low cell numbers down to  $2 \times 10^4$
- 100  $\mu$ L Nucleocuvette™ for high cell numbers up to  $2 \times 10^7$
- 1 mL or LV Nucleocuvette™ Cartridges for large cell numbers up to  $1 \times 10^9$

#### ■ Working with various throughputs?

- Flexible throughput from 1 to 16 samples
- Pre-programming of settings for up to 50 single 100  $\mu$ L Nucleocuvettes™ or one 20  $\mu$ L Nucleocuvette™ Strip
- Kit costs tailored to your throughput

#### ■ Transfecting different primary cell types?

- Five primary cell kits covering a broad range of primary cells
- New Primary Cell Optimization Kit for cells lacking an optimized protocol
- Easy optimization of a variety of cell types using the 96-well Shuttle™ Add-on System

#### ■ Preserving cell functionality?

- Adherent Nucleofection of neurons at later developmental stages
- No release of metal ions due to conductive polymer electrodes

## Adherent Nucleofection Using the Y Unit

Electroporation-based methods have so far required cells to be in suspension for transfection. The Nucleofector™ Technology entered a new era and allows direct Nucleofection of cells in adherence. Cells which typically grow in adherence in cell culture, can be kept and transfected by Nucleofection in their physiological state.

The Y Unit of the 4D-Nucleofector™ System works with disposable conductive polymer Dipping Electrode Arrays that can be inserted into standard 24-well culture plates for Nucleofection.

### ■ Benefits

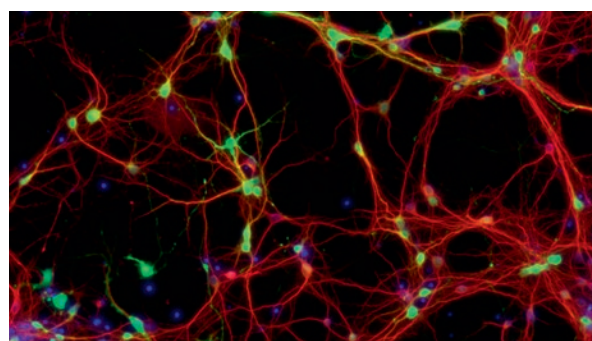
- Pre- and post Nucleofection culture in 24-well culture plates
- Nucleofection of cells at any time point during this culture period, i.e. at a later developmental stage
- Transfection efficiencies up to 70% combined with high viabilities
- Compatible with Clonetics™ Primary Animal Neurons

### ■ Applications

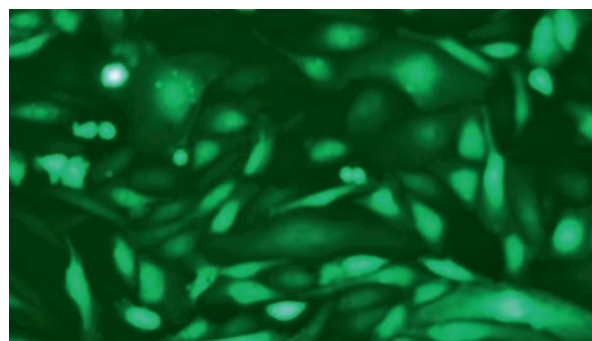
- Enables Nucleofection of cells in adherence in 24-well culture plates

✎ For ordering information and further details, please refer to pages 190 and 200.

🌐 [www.lonza.com/adherent-nucleofection](http://www.lonza.com/adherent-nucleofection)



**Efficient adherent Nucleofection of neurons in 24-well culture plates.** Mouse cortical neurons were seeded into poly-D-lysine coated 24-well plates ( $1 \times 10^5$  cells/well). After 6 DIV, cells were transfected with pmaxGFP™ Vector using the AD1 4D-Nucleofector™ Y Kit. One day post Nucleofection, cells were stained by MAP2 antibody (red) and analyzed by fluorescence microscopy for maxGFP™ protein expression



**Efficient adherent Nucleofection of endothelial cells in 24-well culture plates.** Human umbilical vein endothelial cells (HUVEC) were isolated and plated in passage 1 into collagen-coated 24-well plates at a density of 50,000 cells/well. After 1DIV cells were transfected with 16 µg pmaxGFP™ Vector using AD1 4D-Nucleofector™ Y Solution and program CA-215. Cells were analyzed for maxGFP™ Protein expression after 24h. [Data kindly provided by M. Sauvage, Pharmaceutical Industry, FR]



## Large-Scale Transfection Using the LV Unit

Experience the new functional unit for the 4D-Nucleofector™ System which expands our proven system to larger-scale transfection.

The LV Unit allows for closed, scalable transfection of larger cell numbers in the range of  $1 \times 10^7$  to  $1 \times 10^9$  cells. Transfection protocols can be established in smaller scale using the X Unit and subsequently transferred to the LV Unit without the need for re-optimization. Transferability has been tested for various cell types, including human T cells, CHO-S, HEK293-S, or K562.

### Benefits

- Closed system – Sterile Nucleofection of up to  $10^9$  cells
- Real scalability – Optimization in small scale
- Established protocols – Benefit from 700+ optimized cell types
- Simple handling – Minimal training needs
- 4D-Nucleofector™ LogWare – Optional operation via 21CFR part11 compliant software

### Applications\*

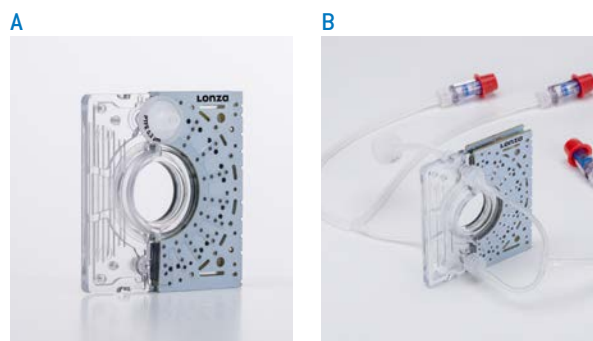
- *Ex-vivo* modification of human primary cells for the development and establishment of cell therapy application (e.g. genome editing, generation of CAR-T cells)
- Transient production of potential therapeutic proteins or antibodies for construct screening
- Generation of large numbers of transiently modified primary cells for cell-based assays

For ordering information and further details, please refer to pages 191.

[www.lonza.com/lv-unit](http://www.lonza.com/lv-unit)



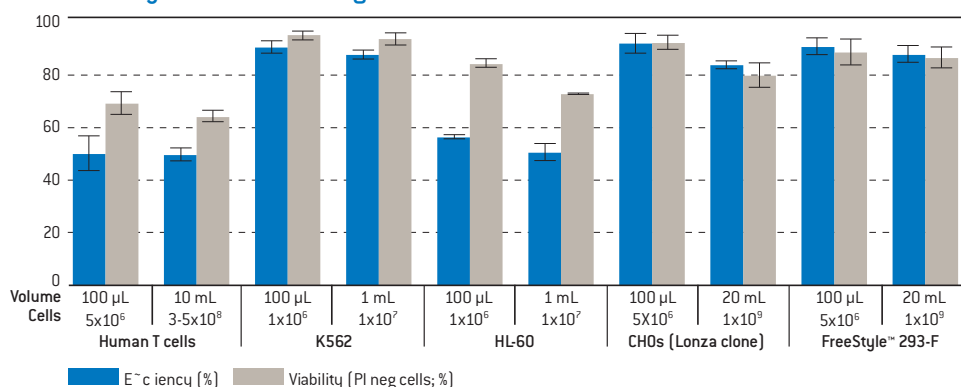
4D Nucleofector™ System with Core, LV Unit, and mounted LV Nucleocuvette™ Cartridge



Two formats available. **[A]** 1 mL Nucleocuvette™ Cartridge: 1 mL filling volume for up to  $1 \times 10^9$  cells (manual filling via sterile injection port) **[B]** LV Nucleocuvette™ Cartridge: Up to 20 mL processing volume (in 1 mL steps) for up to  $1 \times 10^9$  cells (automatic filling via reservoirs or bags)

\*Nucleofector™ Kits and Devices are for research use only and are not intended for human therapeutic or diagnostic use

### Transferability From Small to Large-Scale



Comparison of various exemplary cell types transfected with pmaxGFP™ Vector in small volume (100 µL Nucleocuvette™ Vessels) or larger volumes (1 mL or LV Nucleocuvette™ Cartridge) using the same conditions. Data represent the mean of various independent experiments

## 4D-Nucleofector™ System – Higher Quality Standards

For the 4D-Nucleofector™ System, Lonza offers accessory products which provide higher quality standards for transfection applications in upstream GMP manufacturing environments.

### 4D-Nucleofector™ LogWare

#### ■ Benefits

- Compliance with Title 21 CFR part 11/annex 11
- User administration
- Electronic signatures with user name and password
- Logging of any modification, creation of data or user interaction with time stamp
- Reporting of result failures with failure description
- Data export according to Title 21 CFR part 11
- Generation of audit trails
- No data deletion possible

4D-Nucleofector™ LogWare

Login

User name:

Password:

q w e r t z u i o p  
a s d f g h j k l  
ABC y x c v b n m <X>  
12# Del

LOGIN

### Ordering Information

Cat. No. NA	Cat. No. EU	Product Name
SAAF-1001	SAAF-1001	4D-Nucleofector™ LogWare

NOTE: Nucleofector™ Kits and Devices are for research use only and are not intended for human therapeutic or diagnostic use.

# Nucleofector™ Devices and Systems



Nucleofector™ Devices and Systems

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## 4D-Nucleofector™ System

The 4D-Nucleofector™ System is a modular system comprised of one **Core Unit** and different functional units, each suited for different applications.

### The Core Unit

#### ■ Benefits

- Controls attached functional units
- 5.7" foldable touch screen to operate the system
- Intuitive operation software for designing and saving individual experimental setups
- USB port for software update and data transfer
- Includes USB and serial connectivity for the 96-well Shuttle™ Add-on

#### ■ Applications

- Controlling the 4D-Nucleofector™ System

### The X Unit

#### ■ Benefits

- Features positions for 20 µL Nucleocuvette™ Strips and 100 µL single Nucleocuvette™
- Seamless transfer of conditions between different Nucleofection Vessels
- Includes HV connectivity for the 96-well Shuttle™ System
- Electrically driven drawer for cuvette retainer

#### ■ Applications

- Supporting Nucleofection of various cell numbers in different formats



#### Technical Specifications

Dimensions (w × d × h)	24.5 × 10.5 × 28 cm (9.7 × 4.1 × 11.0 in) System comprising Core Unit and one functional unit
Weight	8.0 kg (17.8 lb) System comprising Core Unit and one functional unit
Power supply	100–110 VAC or 230 VAC, 50–60 Hz, self-regulating
Power consumption	140 VA
Protection	IP 20

### The Y Unit

#### ■ Benefits

- Features positions for one 24-well culture plate with inserted Dipping Electrode Array
- Electrically driven drawer for plate retainer

#### ■ Applications

- Enables Nucleofection of pre-plated cells in adherence in 24-well culture plates

 [www.lonza.com/4d-nucleofector](http://www.lonza.com/4d-nucleofector)

### Ordering Information – Devices

Cat. No. NA	Cat. No. EU	Product Name	Product Description
AAF-1002B	AAF-1002B	4D-Nucleofector™ Core Unit	
AAF-1002X	AAF-1002X	4D-Nucleofector™ X Unit	Requires the Core Unit to build complete system
AAF-1002Y	AAF-1002Y	4D-Nucleofector™ Y Unit	Requires the Core Unit to build complete system
AWA-3001-B	AWA-3001-B	4D-Nucleofector™ Core Unit Guarantee Extension	Valid for 1 year
AWA-3001-X	AWA-3001-X	4D-Nucleofector™ X Unit Guarantee Extension	Valid for 1 year
AWA-3001-Y	AWA-3001-Y	4D-Nucleofector™ Y Unit Guarantee Extension	Valid for 1 year

## 4D-Nucleofector™ System

Continued

### The LV Unit


#### ■ Benefits

- Closed Nucleofection of up to  $10^9$  cells
- Simple scale up of conditions optimized in small scale
- Optional operation via 21CFR part11 compliant software (4D-Nucleofector™ LogWare)

#### ■ Applications\*

- *Ex-vivo* modification of human primary cells for the development and establishment of cell therapy applications (e.g. genome editing, generation of CAR-T cells)
- Transient production of potential therapeutic proteins or antibodies for construct screening
- Generation of large numbers of transiently modified primary cells for cell-based assays



 [www.lonza.com/4d-nucleofector](http://www.lonza.com/4d-nucleofector)  
[www.lonza.com/lv-unit](http://www.lonza.com/lv-unit)

### Ordering Information – Devices

Cat. No. NA	Cat. No. EU	Product Name	Description
<b>Devices</b>			
AAF-1002L	AAF-1002L	4D-Nucleofector™ LV Unit	Including 2 LV reservoir racks. Requires the core unit to build complete system
AWA-3001-LV	AWA-3001-LV	4D-Nucleofector™ LV Unit Guarantee Extension	Valid for 1 year
<b>Accessories</b>			
AAK-3001	AAK-3001	4D-Nucleofector™ LV Reservoir Rack	1 piece
SAAF-1001	SAAF-1001	4D-Nucleofector™ LogWare	
V4LR-1001	V4LR-1001	4D-Nucleofector™ LV Reservoir	2 pieces

\*NOTE: Nucleofector™ Kits and Devices are for research use only and are not intended for human therapeutic or diagnostic use.

NOTE: Nucleofector™ Kits and Devices are for research use only and are not intended for use in humans.



## 96-well Shuttle™ System

The 96-well Shuttle™ System is a medium-throughput add on for the 4D-Nucleofector™ System suited for convenient optimization of Nucleofection Conditions or as an assay establishment tool. The complete system consists of three components:

- The **4D-Nucleofector™ System** (Core Unit and X Unit) serving as the program delivery unit
- The **96-well Shuttle™ System** which mediates the transfer of the respective 96-well program to a specific well of the 96-well Nucleocuvette™ Plate
- A **laptop computer** with the 96-well Shuttle™ Software controlling the interaction between the devices

### Benefits

- Up to 96 independent programs can be run per plate, processed automatically in <5 minutes
- Modular 6 × 16 Nucleocuvette™ Plate for scalable throughput
- Fulfills pre-requisites for liquid handling integration

### Applications

- Optimization of any difficult-to-transfect cell type in just 1 plate
- Variable cell numbers from  $10^4$ – $10^6$  cells per reaction



### Technical Specifications

Dimensions (w × d × h)	34 × 27 × 10 cm (13.39 × 10.63 × 3.94 in)
Weight	3.0 kg (6.6 lb)
Power supply	110 VAC +10%/-20% or 230 VAC +10%/-20% 50–60 Hz, self-regulating
Power consumption	20 VA
Protection	IP 22

### Nucleofector™ 96-well Shuttle™ System



### Ordering Information – Devices

Cat. No. NA	Cat. No. EU	Product Name	Product Description
AAM-1001S	AAM-1001S	96-well Shuttle™ Device	Including Laptop and Nucleofector™ 96-well Shuttle™ Software, 4D-Nucleofector™ Core and X Unit must be purchased separately
AWA-3001-S	AWA-3001-S	96-well Shuttle™ Device Guarantee Extension	Valid for 1 year
AAF-1002B	AAF-1002B	4D-Nucleofector™ Core Unit	
AAF-1002X	AAF-1002X	4D-Nucleofector™ X Unit	Requires the Core Unit to build complete system

## Nucleofector™ 2b Device

The Nucleofector™ Device is the single cuvette based system that has been used in research labs since 2001. It allows efficient transfection of hard-to-transfect cell lines and primary cells with different substrates (e.g., DNA vectors or siRNA oligonucleotides) in low-throughput format. The Nucleofector™ II/2b Device can also be used for bacteria transformation by using alternative cuvettes.

### ■ Benefits

- Highly efficient transfection of primary cells and cell lines
- Reliable results due to high viability and preservation of cell functionality
- Over 150 ready-to-use Optimized Protocols containing cell-type specific guidance

### ■ Applications

- Low-throughput transfection in single cuvette format
- Transfection of plasmid DNA, siRNA, shRNA, miRNA, RNA and more, e.g. Morpholinos
- Transfection of peptides, proteins or small molecules
- Approaching 4,000 peer-reviewed publications
- Suited for bacteria transformation



### Technical Specifications

Dimensions (w x d x h)	30 x 23 x 11 cm (11.81 x 9.06 x 4.33 in)
Weight	2.8 kg (6.2 lb)
Power supply	100–110 VAC or 230 VAC 50–60 Hz, self-regulating
Power consumption	50 VA/fuse T630mA L250V
Protection	IP 20, EN 61010-1, UL 61010A-1

 [www.lonza.com/protocols](http://www.lonza.com/protocols)

### Ordering Information – Devices

Cat. No. NA	Cat. No. EU	Product Name	Product Description	Size
AAB-1001	AAB-1001	Nucleofector™ 2b Device		
AWA-3001-2b	AWA-3001-2b	Nucleofector™ 2b Device Guarantee Extension	Valid for 1 year	
VKA-1001	VKA-1001	Electroporation Cuvettes for Bacteria (1 mm gap)		50 cuvettes

## 384-well Nucleofector™ System

The 384-well Nucleofector™ System is an independent platform for high-throughput Nucleofection in a 384-well format. With an extremely fast plate processing time of 1 minute per plate, it is perfectly suited for screening applications with maximum reproducibility.


The 384-well Nucleofector™ System consists of a Power Supply Unit generating the high voltage pulses, a Plate Handler Unit and an intuitive PC-based Operation Software. The 384-well Nucleofector™ Kits use existing 96-well Shuttle™ Protocols with newly developed conductive polymer 384-well Nucleocuvette™ Plates. For an automated Nucleofection Process that requires long-term storage of cells in Nucleofector™ Solution, some cells may require specialized Automation Kits.

### ■ Benefits

- Processes a 384-well plate in 1 minute
- Uses existing 96-well Shuttle™ Protocols
- Intuitive PC-based Operation Software

### ■ Applications

- High-throughput Nucleofection of low cell numbers down to  $2 \times 10^4$  cells
- Seamless integration into automated liquid handling environments

 Contact Scientific Support for exact guidance regarding optimal kit use.



Power Supply Unit (left), and Plate Handler Unit (right), with loaded 384-well Nucleocuvette™ Plate

### Technical Specifications

Dimensions (w × d × h)	384-well Nucleofector™ Plate Handler: 40 cm × 42 cm × 15 cm (15.7 × 16.5 × 5.9 in)
	384-well Nucleofector™ Power Supply: 13.5 cm × 50 cm × 45 cm (5.3 × 19.6 × 17.7 in)
Weight	384-well Nucleofector™ Plate Handler: 10 kg (22.04 lb)
	384-well Nucleofector™ Power Supply: 14 kg (30.86 lb)

### Ordering Information – Devices

Cat. No. NA	Cat. No. EU	Product Name	Product Description
AAU-1001	AAU-1001	384-well Nucleofector™ System	Includes power supply, plate handler, laptop, and software
AWA-3001-HT	AWA-3001-HT	HT Nucleofector™ System Guarantee Extension	Valid for 1 year
AWT-1001	AWT-1001	384-well Nucleofector™ System Installation and Training	

# Nucleofector™ Kits



## Nucleofector™ Kits


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## Primary Cell Kits for 4D-Nucleofector™ X Unit, 96-well Shuttle™ and 384-well Nucleofector™ Systems

With our conductive polymer cuvette concept, which was first established for the 96-well Shuttle™ System and now transferred to the new platforms, we were able to streamline our kit concept for primary cells. For the 4D-Nucleofector™, 96-well Shuttle™ and 384-well Nucleofector™ Systems we now offer five different Primary Cell Nucleofector™ Solutions P1, P2, P3, P4 and P5.

### ■ Each kit contains

- Specific Nucleofector™ Solution
- Supplement
- pmaxGFP™ Control Vector
- Either single 100 µL Nucleocuvettes™, 16-well Nucleocuvette™ Strips, 96-well or 384-well Nucleocuvette™ Plates

All kits are available in different package variations.  Please refer to ordering information for details. Optimized Protocols are available for download on our website. In these Optimized Protocols the best Nucleofection Conditions are indicated. In addition, we share our experience and knowledge for treatment of individual primary cell types. You can always find the most up-to-date information in our online cell database.

### ■ Benefits



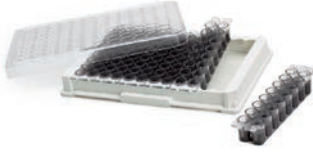

- Five different Nucleofector™ Solutions – One Nucleofector™ Kit can be used for multiple primary cell types
- Conditions are transferable between 4D Nucleofector™ System, 96-well Shuttle™ System and 384-well Nucleofector™ System
- Primary cells maintain functionality post transfection

### ■ Applications

- Transfection of lower cell numbers (from  $2 \times 10^4$  to  $1 \times 10^6$  cells) and higher cell numbers (from  $2 \times 10^5$  to  $2 \times 10^7$  cells) is possible
- Flexible throughput from single cuvette (100 µL) to 16-well Nucleocuvette™ Strip (20 µL), 96-well and 384-well Nucleocuvette™ Plates is possible

 [www.lonza.com/celldatabase](http://www.lonza.com/celldatabase)

 [www.lonza.com/protocols](http://www.lonza.com/protocols)

100 µL Nucleocuvette™ [4D-Nucleofector™ System]	16-well Nucleocuvette™ Strip [4D-Nucleofector™ System]	96-well Nucleocuvette™ Plate [96-well Shuttle™ System]	384-well Nucleocuvette™ Plate [384-well Nucleofector™ System]
			

Ordering information on the next page.



# Primary Cell Kits for 4D-Nucleofector™ X Unit, 96-well Shuttle™ and 384-well Nucleofector™ Systems

Continued

## Ordering Information – Kits

Cat. No.	Description	Size
<b>4D-Nucleofector™ Kits</b>		
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-2012	P2 Primary Cell 4D-Nucleofector™ X Kit L	12 rxn (100 µL Nucleocuvette™)
V4XP-2024		24 rxn (100 µL Nucleocuvette™)
V4XP-2032	P2 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		24 rxn (100 µL Nucleocuvette™)
V4XP-4032	P4 Primary Cell 4D-Nucleofector™ X Kit S	32 rxn (20 µL Nucleocuvette™; 16-well)
V4XP-5012	P5 Primary Cell 4D-Nucleofector™ X Kit L	12 rxn (100 µL Nucleocuvette™)
V4XP-5024		24 rxn (100 µL Nucleocuvette™)
V4XP-5032	P5 Primary Cell 4D-Nucleofector™ X Kit S	32 rxn (20 µL Nucleocuvette™; 16-well)
<b>96-well Shuttle™ Kits</b>		
V4SP-1096	P1 Primary Cell 96-well-Nucleofector™ Kit	96 rxn (20 µL Nucleocuvette™; 96-well)
V4SP-1960		960 rxn (20 µL Nucleocuvette™; 96-well)
V4SP-2096	P2 Primary Cell 96-well-Nucleofector™ Kit	96 rxn (20 µL Nucleocuvette™; 96-well)
V4SP-2960		960 rxn (20 µL Nucleocuvette™; 96-well)
V4SP-3096	P3 Primary Cell 96-well-Nucleofector™ Kit	96 rxn (20 µL Nucleocuvette™; 96-well)
V4SP-3960		960 rxn (20 µL Nucleocuvette™; 96-well)
V4SP-4096	P4 Primary Cell 96-well-Nucleofector™ Kit	96 rxn (20 µL Nucleocuvette™; 96-well)
V4SP-4960		960 rxn (20 µL Nucleocuvette™; 96-well)
V4SP-5096	P5 Primary Cell 96-well-Nucleofector™ Kit	96 rxn (20 µL Nucleocuvette™; 96-well)
V4SP-5960		960 rxn (20 µL Nucleocuvette™; 96-well)
<b>384-well Nucleofector™ Kits</b>		
V5SP-1002	P1 Primary Cell 384-well Nucleofector™ Kit	768 rxn (20 µL Nucleocuvette™; 384-well)
V5SP-1010		3840 rxn (20 µL Nucleocuvette™; 384-well)
V5SP-2002	P2 Primary Cell 384-well Nucleofector™ Kit	768 rxn (20 µL Nucleocuvette™; 384-well)
V5SP-2010		3840 rxn (20 µL Nucleocuvette™; 384-well)
V5SP-3002	P3 Primary Cell 384-well Nucleofector™ Kit	768 rxn (20 µL Nucleocuvette™; 384-well)
V5SP-3010		3840 rxn (20 µL Nucleocuvette™; 384-well)
V5SP-4002	P4 Primary Cell 384-well Nucleofector™ Kit	768 rxn (20 µL Nucleocuvette™; 384-well)
V5SP-4010		3840 rxn (20 µL Nucleocuvette™; 384-well)
V5SP-5002	P5 Primary Cell 384-well Nucleofector™ Kit	768 rxn (20 µL Nucleocuvette™; 384-well)
V5SP-5010		3840 rxn (20 µL Nucleocuvette™; 384-well)

# Primary Cell Kits for 4D-Nucleofector™ X Unit, 96-well Shuttle™ and 384-well Nucleofector™ Systems

Continued

## Quick Reference Guide

Cell types	Efficiency	Viable cells	Solution	Kits for 4D-Nucleofector™ [Cat. No.]			Kits for 96-well Shuttle™ [Cat. No.]	
				100 µL (12 rxn) Cat. No.	100 µL (24 rxn) Cat. No.	20 µL (32 rxn) Cat. No.	20 µL (96 rxn) Cat. No.	20 µL (960 rxn) Cat. No.
Adipocytes								
Pre-adipocytes, human, visceral	37-94%	35-90%	P1	V4XP-1012	V4XP-1024	V4XP-1032	V4SP-1096	V4SP-1960
Pre-adipocytes, human, subcutaneous	51-84%	33-85%	P1	V4XP-1012	V4XP-1024	V4XP-1032	V4SP-1096	V4SP-1960
Pre-adipocytes, human, visceral (Diabetes Type II)	28-65%	64-84%	P1	V4XP-1012	V4XP-1024	V4XP-1032	V4SP-1096	V4SP-1960
Pre-adipocytes, human, subcutaneous (Diabetes Type II)	31-70%	61-95%	P1	V4XP-1012	V4XP-1024	V4XP-1032	V4SP-1096	V4SP-1960
Bone/Cartilage Cells								
Chondrocyte, human	74%	84%	P3	V4XP-3012	V4XP-3024	V4XP-3032	V4SP-3096	V4SP-3960
Dermal Cells								
Keratinocyte, human (NHEK)	60–70%	50–60%	P3	V4XP-3012	V4XP-3024	V4XP-3032	V4SP-3096	V4SP-3960
Endothelial Cells								
Endothelial, aortic (HAEC), human	73%	70%	P5	V4XP-5012	V4XP-5024	V4XP-5032	V4SP-5096	V4SP-5960
Endothelial, microvascular, lung (HMVEC-L), human	79%	48%	P5	V4XP-5012	V4XP-5024	V4XP-5032	V4SP-5096	V4SP-5960
Endothelial, umbilical vn.(HUVEC), human	90%	55%	P5	V4XP-5012	V4XP-5024	V4XP-5032	V4SP-5096	V4SP-5960
Epithelial Cells								
Epithelial, bronchial (NHBE), human	54%	53%	P3	V4XP-3012	V4XP-3024	V4XP-3032	V4SP-3096	V4SP-3960
Epithelial, bronchial, human, asthmatic	72%	75%	P3	V4XP-3012	V4XP-3024	V4XP-3032	V4SP-3096	V4SP-3960
Epithelial, bronchial, human, COPD	63%	80%	P3	V4XP-3012	V4XP-3024	V4XP-3032	V4SP-3096	V4SP-3960
Epithelial, mammary (HMEC), human	51%	66%	P3	V4XP-3012	V4XP-3024	V4XP-3032	V4SP-3096	V4SP-3960
Epithelial, prostate (PrEC), human	67%	48%	P1	V4XP-1012	V4XP-1024	V4XP-1032	V4SP-1096	V4SP-1960
Fibroblasts								
Fibroblast, dermal (NHDF), human – adult	92–96%	92–100%	P2	V4XP-2012	V4XP-2024	V4XP-2032	V4SP-2096	V4SP-2960
Fibroblast, dermal (NHDF), human – neo	98%	86-91%	P2	V4XP-2012	V4XP-2024	V4XP-2032	V4SP-2096	V4SP-2960
Fibroblast, embryonic (MEF), mouse	68%	85-90%	P4	V4XP-4012	V4XP-4024	V4XP-4032	V4SP-4096	V4SP-4960
Hematopoietic Cells								
B cell, mouse, stimulated	55–56%	41–87%	P4	V4XP-4012	V4XP-4024	V4XP-4032	V4SP-4096	V4SP-4960
B cell, peripheral blood, CD19+, human	28%	70%	P3	V4XP-3012	V4XP-3024	V4XP-3032	V4SP-3096	V4SP-3960
Dendritic cell, human, immature (mRNA)	69%	84%	P3	V4XP-3012	V4XP-3024	V4XP-3032	V4SP-3096	V4SP-3960
Dendritic cell, human, mature (DNA)	87%	40–80%	P3	V4XP-3012	V4XP-3024	V4XP-3032	V4SP-3096	V4SP-3960
Dendritic cell, mouse, mature – BALB/c	32%	85%	P3	V4XP-3012	V4XP-3024	V4XP-3032	V4SP-3096	V4SP-3960
Dendritic cell, mouse, immat. – BALB/c	43%	37–49%	P4	V4XP-4012	V4XP-4024	V4XP-4032	V4SP-4096	V4SP-4960
Dendritic cell, mouse, mature – C57BL/6	29%	88%	P3	V4XP-3012	V4XP-3024	V4XP-3032	V4SP-3096	V4SP-3960
Dendritic cell, mouse, immat. – C57BL/6	34%	41–58%	P4	V4XP-4012	V4XP-4024	V4XP-4032	V4SP-4096	V4SP-4960

# Primary Cell Kits for 4D-Nucleofector™ X Unit, 96-well Shuttle™ and 384-well Nucleofector™ Systems

Continued

## Quick Reference Guide

Cell types	Efficiency	Viable cells	Solution	Kits for 4D-Nucleofector™ (Cat. No.)			Kits for 96-well Shuttle™ (Cat. No.)	
				100 µL (12 rxn) Cat. No.	100 µL (24 rxn) Cat. No.	20 µL (32 rxn) Cat. No.	20 µL (96 rxn) Cat. No.	20 µL (960 rxn) Cat. No.
Macrophage, human	42%	60%	P3	V4XP-3012	V4XP-3024	V4XP-3032	V4SP-3096	V4SP-3960
Macrophage, mouse – BALB/c	33–37%	41%	P2	V4XP-2012	V4XP-2024	V4XP-2032	V4SP-2096	V4SP-2960
Monocyte CD14 <sup>+</sup> , human	64%	77%	P3	V4XP-3012	V4XP-3024	V4XP-3032	V4SP-3096	V4SP-3960
T cell, human stimulated	70%	59%	P3	V4XP-3012	V4XP-3024	V4XP-3032	V4SP-3096	V4SP-3960
T cell, human unstimulated	69–87%	53–79%	P3	V4XP-3012	V4XP-3024	V4XP-3032	V4SP-3096	V4SP-3960
T cell, mouse – BALB/c	45%	32%	P3	V4XP-3012	V4XP-3024	V4XP-3032	V4SP-3096	V4SP-3960
T cell, mouse – C57BL/6	43%	23%	P3	V4XP-3012	V4XP-3024	V4XP-3032	V4SP-3096	V4SP-3960
<b>Hepatocytes</b>								
Hepatocyte, human	54%	59–69%	P3	V4XP-3012	V4XP-3024	V4XP-3032	V4SP-3096	V4SP-3960
<b>Muscle Cells</b>								
Skeletal Muscle Myoblasts, human	72–78%	61%	P5	V4XP-5012	V4XP-5024	V4XP-5032	V4SP-5096	V4SP-5960
SMC, aortic (AoSMC), human	80%	53–80%	P1	V4XP-1012	V4XP-1024	V4XP-1032	V4SP-1096	V4SP-1960
<b>Neural Cells</b>								
Neuron, cortical, rat	30–50%		P3	V4XP-3012	V4XP-3024	V4XP-3032	V4SP-3096	V4SP-3960
Neuron, hippocampal, rat	30–50%		P3	V4XP-3012	V4XP-3024	V4XP-3032	V4SP-3096	V4SP-3960
<b>Stem Cells</b>								
CD34 <sup>+</sup> cell, bone marrow, human	62–70%	79–91%	P3	V4XP-3012	V4XP-3024	V4XP-3032	V4SP-3096	V4SP-3960
CD34 <sup>+</sup> cell, cord blood, human	83%	62%	P3	V4XP-3012	V4XP-3024	V4XP-3032	V4SP-3096	V4SP-3960
Embryonic stem (ES) cell, human	64%	98%	P3	V4XP-3012	V4XP-3024	V4XP-3032	V4SP-3096	V4SP-3960
Embryonic stem (ES) cell, mouse	86–90%	68–81%	P3	V4XP-3012	V4XP-3024	V4XP-3032	V4SP-3096	V4SP-3960
Mesenchymal stem cells (MSC), human	69–78%	67–71%	P1	V4XP-1012	V4XP-1024	V4XP-1032	V4SP-1096	V4SP-1960

## Adherent Nucleofector™ Kits for 4D-Nucleofector™ Y Unit

For adherent Nucleofection using the 4D-Nucleofector™ Y Unit, specific kits are required including an optimized 24-well Dipping Electrode Array made with conductive polymer electrodes.

Following our new simplified kit strategy invented with the 4D-Nucleofector™ System we offer two Nucleofector™ Solutions called AD1 and AD2, both available as separate kits or combined in to an optimization kit. Each solution may serve different cell types. You can easily find out which solution is optimal for your cell of interest by using the schematic on the right.



### Each kit contains

- Specific Nucleofector™ Solution
- Supplement
- pmaxGFP™ Control Vector
- 24-well Dipping Electrode Array
- Nunclon™ Δ Surface 24-well plate (Nunc)

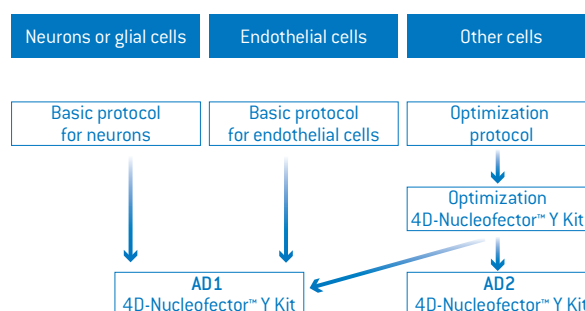
### Benefits

- Nucleofection of cells at any time point during this culture period, i.e. at a later developmental stage
- Transfection efficiencies up to 70% combined with high viabilities

### Applications

- Two 4D-Nucleofector™ Y Kits that may serve different cell types
- An Optimization 4D-Nucleofector™ Y Kit for primary cells or cell lines lacking an Optimized Protocol

 [www.lonza.com/celldatabase](http://www.lonza.com/celldatabase)



### Ordering Information – Kits

Cat. No. NA	Cat. No. EU	Product Name	Product Description	Size
<b>Adherent Nucleofection Kits</b>				
V4YP-1A24	V4YP-1A24	AD1 4D-Nucleofector™ Y Kit	24-well Dipping Electrode	24 reactions
V4YP-2A24	V4YP-2A24	AD2 4D-Nucleofector™ Y Kit	24-well Dipping Electrode	24 reactions
V4YP-9A48	V4YP-9A48	Primary Cell Optimization 4D-Nucleofector™ Y Kit	24-well Dipping Electrode	48 reactions

Related Products	Page
4D-Nucleofector™ Y Unit	190

## Primary Cell Kits for 4D-Nucleofector™ LV Unit

For large scale-transfection using the new 4D-Nucleofector™ LV Unit we offer two different Nucleocuvette™ Cartridge formats: a fixed volume cartridge for 1 mL and a flow-through cartridge for up to 20 mL.

Experimental conditions that were established in smaller scale on the 4D-Nucleofector™ X Unit can be transferred onto these larger-scale formats without re-optimization. For cell-type specific protocols and further guidelines, please contact Lonza Scientific Support.

From the five primary cell solutions (P1 – P5) P3 is available for the large-scale formats so far, which is suited for most immune and stem cells (e.g. T cells, dendritic cells, CD34 hematopoietic stem cells). Other solutions are available on request.

### ■ Each kit contains

- Specific Nucleofector™ Solution
- Supplement
- pmaxGFP™ Control Vector
- Either 1mL Nucleocuvette™ Cartridge or LV Nucleocuvette™ Cartridge with tubing and 2 reservoirs


### ■ Applications - 1 mL Nucleocuvette™ Cartridge

- 1 mL filling volume
- For transfection of up to  $1 \times 10^8$  cells
- Manual filling via sterile injection port

### ■ Applications - LV Nucleocuvette™ Cartridge

- Up to 20 mL processing volume (in 1 mL steps)
- For scalable transfection of  $1 \times 10^8$  to  $1 \times 10^9$  cells
- Automatic filling via reservoirs or bags
- Allows for separate feeding of mRNA to avoid degradation

For quality information or additional options, please contact Lonza Scientific Support.

 [www.lonza.com/lv-unit](http://www.lonza.com/lv-unit)

### Ordering Information – Kits

Cat. No. NA	Cat. No. EU	Product Name	Product Description	Size
<b>4D-Nucleofector™ Kits</b>				
V4LP-3002	V4LP-3002	P3 Primary Cell 4D-Nucleofector™ LV Kit L	1 mL Nucleocuvette™ Cartridge	2 reactions
V4LP-3020	V4LP-3020	P3 Primary Cell 4D-Nucleofector™ LV Kit XL	LV Nucleocuvette™ Cartridge	1 reaction
V4LP-3520	V4LP-3520	P3 Primary Cell 4D-Nucleofector™ LV Kit XL	LV Nucleocuvette™ Cartridge	5 × 1 reaction
<b>Accessories</b>				
V4LR-1001	V4LR-1001	4D-Nucleofector™ LV Reservoir		2 pieces



1 mL Nucleocuvette™ Cartridge



LV Nucleocuvette™ Cartridge with tubing



4D-Nucleofector™ LV Reservoirs



## Primary Cell Optimization Kits for 4D-Nucleofector™ X Unit, 96-well Shuttle™ and 384-well Nucleofector™ Systems

The Primary Cell Optimization Nucleofector™ Kits are the ideal tool to conveniently and rapidly determine Nucleofection Conditions for primary cell types lacking an Optimized Protocol.

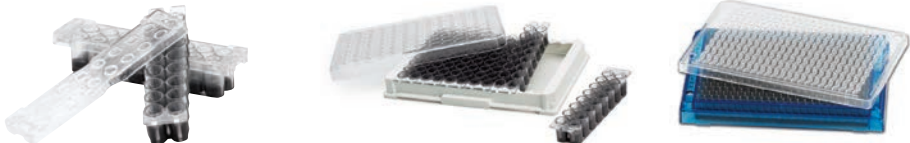
Different conditions can easily be tested within one experiment using any of the Nucleofector™ Platforms (4D-Nucleofector™, 96-well Shuttle™ and 384-well Nucleofector™ System) as all of them are able to address individual wells of a 16-well, 96-well or 384-well Nucleocuvette™ Plate with different programs. In each system our five Primary Cell Nucleofector™ Solutions P1 – P5 are tested together with a pre-selected set of programs plus controls.

### Benefits

- Convenient and rapid determination of optimal Nucleofection Conditions for a broad range of primary cells within one experiment
- Optimal Nucleofection Conditions determined on one platform are transferable to the other platforms and also to the 100 µL single Nucleocuvette™ in the 4D-Nucleofector™ X Unit

### Applications

- Determination of Nucleofection Conditions for primary cell types lacking an Optimized Protocol

Platform	4D-Nucleofector™ System	96-well Shuttle™ System	384-well Nucleofector™ System
Nucleocuvette™ Vessel			
Kit contents	<ul style="list-style-type: none"> <li>- Six 16-well Nucleocuvette™ Strips</li> <li>- Specific Nucleofector™ Solution</li> <li>- Supplement</li> <li>- pmaxGFP™ Control Vector</li> </ul>	<ul style="list-style-type: none"> <li>- Two 96-well Nucleocuvette™ Plates</li> <li>- Specific Nucleofector™ Solution</li> <li>- Supplement</li> <li>- pmaxGFP™ Control Vector</li> </ul>	<ul style="list-style-type: none"> <li>- One 384-well Nucleocuvette™ Plate</li> <li>- Specific Nucleofector™ Solution</li> <li>- Supplement</li> <li>- pmaxGFP™ Control Vector</li> </ul>
Number of optimization reactions	80 rxn (plus 16 rxn for optional fine tuning)	160 reactions	384 reactions

### Ordering Information – Kits

Cat. No. NA	Cat. No. EU	Product Name	Product Description	Size
<b>4D-Nucleofector™ Kits</b>				
V4XP-9096	V4XP-9096	Primary Cell Optimization 4D-Nucleofector™ X Kit	20 µL Nucleocuvette™ Strip	96 reactions (16-well)
<b>96-well Shuttle™ Kits</b>				
V4SP-9096	V4SP-9096	Primary Cell Optimization 96-well Nucleofector™ Kit	20 µL Nucleocuvette™ Plate	160 reactions (96-well)
<b>384-well Nucleofector™ Kits</b>				
V5SP-9001	V5SP-9001	Primary Cell Optimization 384-well Nucleofector™ Kit	20 µL Nucleocuvette™ Plate	384 reactions (384-well)

## Primary Cell Kits for Nucleofector™ II/2b Device

The Nucleofector™ II/2b uses cell type specific kits, each of them dedicated to an individual primary cell. Individually developed Nucleofector™ Kits are available for each primary cell type to use in combination with the Nucleofector™ II/2b Device.

### ■ Each Kit Contains

- Specific Nucleofector™ Solution
- Supplement
- Single use pipettes
- pmaxGFP™ Control Vector
- Certified 100 µL aluminum electrode cuvettes

All Primary Cell Kits for the Nucleofector™ II/2b Device are available in different package variations (10, 25 and 4 × 25 reactions) and include a CD containing all cell-type specific Optimized Protocols. The best Nucleofection Conditions are indicated in these optimized protocols. In addition we share our experience and knowledge for treatment of individual primary cell types. You can always find the most up-to-date information in our online cell database.

 [www.lonza.com/celldatabase](http://www.lonza.com/celldatabase)

 See pages 205-259

### Quick Reference Guide

			Kits for Nucleofector™ II/ 2b [Cat. No.]		
Cell types	Efficiency	Viable cells	10 rxn Cat. No.	25 rxn Cat. No.	100 rxn Cat. No.
Bone/Cartilage Cells					
Chondrocyte, human	65%	60-70%		VPF-1001	WVPF-1001
Cardiac Cells					
Cardiomyocyte, rat	75-80%	50-60%	VAPE-1002	VPE-1002	WVPE-1002
Dermal Cells					
Keratinocyte, adult [NHEK-Ad], human	51%	40-60%	VAPD-1002	VPD-1002	WVPD-1002
Keratinocyte, neonatal [NHEK-neo], human	39-53%	50-60%	VAPD-1002	VPD-1002	WVPD-1002
Melanocyte, neonatal [NHEM-neo], human	70%	55-60%	VAPD-1003	VPD-1003	WVPD-1003
Endothelial Cells					
Endothelial, coronary artery [HCAEC], human	57%	42%		VPB-1001	WVPB-1001
Endothelial, microvascular, lung [HMVEC-L], human	52%	52%		VPB-1003	WVPB-1003
Endothelial, umbilical vein [HUVEC], human	90%	60-74%	VAPB-1002	VPB-1002	WVPB-1002
Epithelial Cells					
Epithelial, bronchial [NHBE], human	50-65%	50%	VAPI-1005	VPI-1005	WVPI-1005
Epithelial, mammary [HMEC], human	73%	66-98%		VPK-1002	WVPK-1002
Epithelial, prostate [PrEC], human	43%	64%	VAPI-1005	VPI-1005	WVPI-1005
Fibroblasts					
Embryonic fibroblast [MEF], mouse	43%	60-80%	VPD-1006*		
Fibroblast, dermal [NHDF], human – adult	42-69%	74-77%	VAPD-1001	VPD-1001	WVPD-1001
Fibroblast, dermal [NHDF], human – neo	90%	85-90%	VAPD-1001	VPD-1001	WVPD-1001
*Starter Kit: different reaction size					
Hematopoietic Cells					
B cell, peripheral blood, CD19+, human	36%	84-92%	VAPA-1001	VPA-1001	WVPA-1001
B cell, mouse, stimulated	59%	27-47%	VAPA-1010	VPA-1010	WVPA-1010
Dendritic cell, human	93-99%	12-75%	VAPA-1004	VPA-1004	WVPA-1004
Dendritic cell, mouse, immature – BALB/c	58%	62%	VAPA-1011	VPA-1011	WVPA-1011

\*Starter Kit: different reaction size.

# Primary Cell Kits for Nucleofector™ II/2b Device

Continued

## Quick Reference Guide

Cell types	Efficiency	Viable cells	Kits for Nucleofector™ II/ 2b (Cat. No.)		
			10 rxn Cat. No.	25 rxn Cat. No.	100 rxn Cat. No.
Dendritic cell, mouse, immature – C57BL/6	54%	52%	VAPA-1011	VPA-1011	WPA-1011
Dendritic cell, mouse, mature – BALB/c	49%	78%	VAPA-1011	VPA-1011	WPA-1011
Dendritic cell, mouse, mature – C57BL/6	37%	63%	VAPA-1011	VPA-1011	WPA-1011
Macrophage, human	55-59%	87-88%	VAPA-1008	VPA-1008	WPA-1008
Macrophage, mouse – BALB/c	34-45%	84-92%	VAPA-1009	VPA-1009	WPA-1009
Macrophage, mouse – C57BL/6	24-47%	80-88%	VAPA-1009	VPA-1009	WPA-1009
Monocyte CD14 <sup>+</sup> , human	60%	62-81%		VPA-1007	WPA-1007
Natural killer (NK), human	54%	50-60%	VAPA-1005	VPA-1005	WPA-1005
T cell, human stimulated	41-47%	83-90%	VAPA-1002	VPA-1002	WPA-1002
T cell, human unstimulated	70-75%	85%	VAPA-1002	VPA-1002	WPA-1002
T cell, mouse – BALB/c	44%	18-55%		VPA-1006	WPA-1006
T cell, mouse – C57BL/6	20-28%	17-45%		VPA-1006	WPA-1006

## Hepatocytes

Hepatocyte, mouse	54%	80%	VAPL-1004	VPL-1004	WPL-1004
Hepatocyte, rat	52%	78%	VAPL-1004	VPL-1004	WPL-1004

## Neural Cells

Astrocyte, mixed brain, C57 mouse	60%	60-70%	VAPI-1006	VPI-1006	WPI-1006
Astrocyte, mixed brain, CD1 mouse	60%	60-70%	VAPI-1006	VPI-1006	WPI-1006
Astrocytes, striatum, rat	67%	70-80%	VAPI-1006	VPI-1006	WPI-1006
Dorsal root ganglia (DRG), rat	41%		VAPG-1003	VPG-1003	WPG-1003
Dorsal root ganglia (DRG), chicken	30%			VPG-1002	WPG-1002
Neuron, cortical, rat	58-67%	47-60%	VAPG-1003	VPG-1003	WPG-1003
Neuron, hippocampal, chicken	43%			VPG-1002	WPG-1002
Neuron, hippocampal, rat	58-67%	47-60%	VAPG-1003	VPG-1003	WPG-1003
Neuron, hippocampal, mouse	58%		VAPG-1001	VPG-1001	WPG-1001
Oligodendrocyte, rat	44%	60%	VAPI-1006	VPI-1006	WPI-1006

## Smooth Muscle Cells

Smooth muscle cell, aortic (AoSMC), human	75%	69-96%	VAPC-1001	VPC-1001	WPC-1001
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## Stem Cells

CD34 <sup>+</sup> cell, bone marrow, human	82%	70%	VAPA-1003	VPA-1003	WPA-1003
Embryonic stem (ES) cell, human	20-78%	50-96%	VPH-5002*		
Embryonic stem (ES) cell, mouse	87-90%	90-99%	VAPH-1001	VPH-1001	WPH-1001
Mesenchymal stem cell (MSC), human	55-88%	50-86%	VAPE-1001	VPE-1001	WPE-1001
Neural stem cell (NSC), mouse	82%		VAPG-1004	VPG-1004	WPG-1004
Neural stem cell (NSC), rat	42-46%			VPG-1005	WPG-1005

\*Starter Kit: different reaction size

## Nucleofector™ Kits for Human Pre-Adipocytes

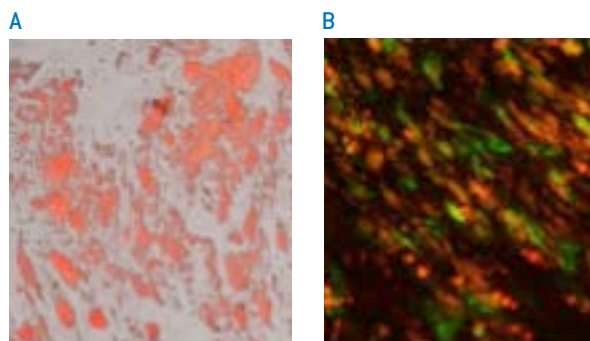
Optimal kits for transfection of human pre-adipocytes in the 4D-Nucleofector™ X Unit are the P1 Primary Cell Kits, used in combination with the cell-type specific protocol. Due to transferability between all platforms, same conditions apply for the 96-well Shuttle™ or 384-well Nucleofector™ Systems.

### ■ Benefits

- Transfection efficiency: up to 90%
- Viability: up to 80%
- Cells can be differentiated into adipocytes post Nucleofection

### ■ Applications

- Validated to work with visceral and subcutaneous Poietics™ Human Preadipocytes
- Also tested with Diabetes Type II pre-adipocytes
- Easily verify previous cell line results in the analogous primary cell type



**Example of Nucleofection of human pre-adipocytes.** Poietics™ Human Visceral Preadipocytes were transfected with pmaxGFP™ Vector and differentiated into adipocytes post Nucleofection using PGM™ 2 Adipocyte Differentiation Medium. After 14 days cells were analyzed by AdipoRed™ Assay [A] Non-transfected control; [B] transfected cells]. Quantitative analysis showed that more than 80% of transfected sample stained positive for AdipoRed (normalized to non-transfected control set to 100%).

### Ordering Information – Kits

Cat. No. NA	Cat. No. EU	Product Name	Product Description	Size
<b>4D-Nucleofector™ Kits</b>				
V4XP-1012	V4XP-1012	P1 Primary Cell 4D-Nucleofector™ X Kit L	100 µL Nucleocuvette™ Vessel	12 reactions
V4XP-1024	V4XP-1024	P1 Primary Cell 4D-Nucleofector™ X Kit L	100 µL Nucleocuvette™ Vessel	24 reactions
V4XP-1032	V4XP-1032	P1 Primary Cell 4D-Nucleofector™ X Kit S	20 µL Nucleocuvette™ Strip	32 reactions (16-well)
<b>96-well Shuttle™ Kits</b>				
V4SP-1096	V4SP-1096	P1 Primary Cell 96-well Nucleofector™ Kit	20 µL Nucleocuvette™ Plate	96 reactions (96-well)
V4SP-1960	V4SP-1960	P1 Primary Cell 96-well Nucleofector™ Kit	20 µL Nucleocuvette™ Plate	960 reactions (96-well)
<b>384-well Nucleofector™ Kits</b>				
V5SP-1002	V5SP-1002	P1 Primary Cell 384-well Nucleofector™ Kit	20 µL Nucleocuvette™ Plate	768 reactions (384-well)
V5SP-1010	V5SP-1010	P1 Primary Cell 384-well Nucleofector™ Kit	20 µL Nucleocuvette™ Plate	3840 reactions (384-well)

Related Products	Page
Human Preadipocyte Cells, normal or diseased	27
PGM™ 2 Preadipocyte Growth Medium-2 BulletKit™	28
AdipoRed™ Assay Reagent	287

## Nucleofector™ Kits for Human B Cells

Various Nucleofector™ Kits and corresponding Optimized Protocols are available for the transfection of human B cells using the different Nucleofection Platforms.

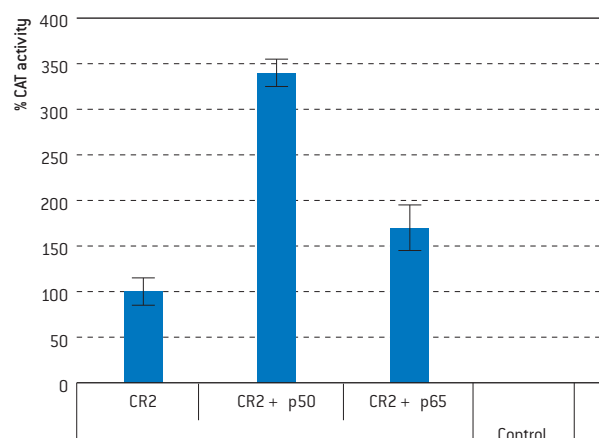
Optimal kits for transfection of human B cells in the 4D-Nucleofector™, 96-well Shuttle™ or 384-well Nucleofector™ System are the P3 Primary Cell Kits used in combination with cell-type specific protocols. Human B cell specific kits are available for the Nucleofector™ II/2b Device.

### ■ Benefits

- Transfection efficiency: up to 36% using a non-viral method
- Viability: up to 92%

### ■ Applications

- Kits suitable for human CD19<sup>+</sup> B cells from peripheral blood
- Also applicable for transfection of CLL cells derived from patient material
- For both unstimulated and stimulated B cells
- Same conditions for DNA, siRNA, or RNA



Promoter studies in primary B cells prove that NF-KB regulates the activity of the human CR2 promoter. Primary human B cells were transiently co-transfected with a CAT reporter plasmid driven by wild-type (WT) CR2 promoter, and plasmids encoding NF-KB subunit p50 or p65 or a control plasmid. Cells were assayed for CAT activity 15 hours post Nucleofection. Values represent percentage of CAT activity, considering the activity of the empty vector control 0% and the activity of the wild-type CR2 promoter 100%. The results demonstrate that both NF-KB subunits clearly induce CAT activity. [Data reproduced from Tolnay et al. (2002) J Immunology, with permission from the Journal of Immunology.]

### Ordering Information – Kits

Cat. No. NA	Cat. No. EU	Product Name	Product Description	Size
<b>4D-Nucleofector™ Kits</b>				
V4XP-3012	V4XP-3012	P3 Primary Cell 4D-Nucleofector™ X Kit L	100 µL Nucleocuvette™ Vessel	12 reactions
V4XP-3024	V4XP-3024	P3 Primary Cell 4D-Nucleofector™ X Kit L	100 µL Nucleocuvette™ Vessel	24 reactions
V4XP-3032	V4XP-3032	P3 Primary Cell 4D-Nucleofector™ X Kit S	20 µL Nucleocuvette™ Strip	32 reactions (16-well)
<b>96-well Shuttle™ Kits</b>				
V4SP-3096	V4SP-3096	P3 Primary Cell 96-well Nucleofector™ Kit	20 µL Nucleocuvette™ Plate	96 reactions (96-well)
V4SP-3960	V4SP-3960	P3 Primary Cell 96-well Nucleofector™ Kit	20 µL Nucleocuvette™ Plate	960 reactions (96-well)
<b>384-well Nucleofector™ Kits</b>				
V5SP-3002	V5SP-3002	P3 Primary Cell 384-well Nucleofector™ Kit	20 µL Nucleocuvette™ Plate	768 reactions (384-well)
V5SP-3010	V5SP-3010	P3 Primary Cell 384-well Nucleofector™ Kit	20 µL Nucleocuvette™ Plate	3840 reactions (384-well)
<b>Nucleofector™ II/2b Kits</b>				
VAPA-1001	VAPA-1001	Human B Cell Nucleofector™ II/ 2b Kit	100 µL aluminum cuvette	10 reactions
VPA-1001	VPA-1001	Human B Cell Nucleofector™ II/ 2b Kit	100 µL aluminum cuvette	25 reactions
VVPA-1001	VVPA-1001	Human B Cell Nucleofector™ II/ 2b Kit	100 µL aluminum cuvette	4 × 25 reactions

Related Products	Page
RPMI 1640 without L-Glutamine	131
LGM™ 3 Lymphocyte Growth Medium-3	102 - 106
X-VIVO™ 20 Chemically Defined, Serum-free Hematopoietic Cell Medium	141



## Nucleofector™ Kits for Stimulated Mouse B Cells

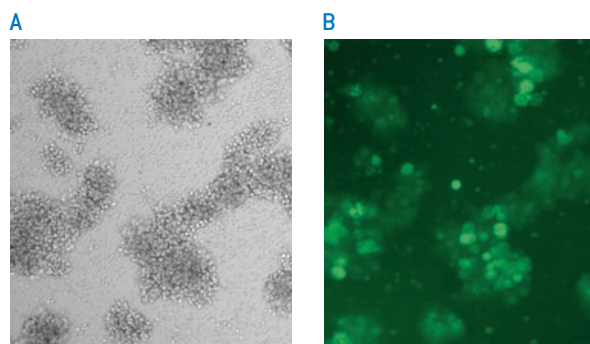
Various Nucleofector™ Kits and corresponding Optimized Protocols are available for the transfection of stimulated mouse B cells using the different Nucleofection Platforms. Optimal kits for transfection of mouse B cells in the 4D-Nucleofector™, 96-well Shuttle™ or 384-well Nucleofector™ System are the P4 Primary Cell Kits used in combination with cell-type specific protocols. Mouse B cell specific kits are available for the Nucleofector™ II/2b Device.

### ■ Benefits

- Transfection efficiency: up to 59%
- Viability: up to 87%
- Expression of cell typical marker proteins not affected

### ■ Applications

- Kits suitable for stimulated mouse B cells
- Same conditions for DNA, siRNA and RNA transfection



**Nucleofection of mouse B cells.** Primary mouse B cells were transfected by Nucleofection using a plasmid encoding maxGFP™ Reporter Protein. Cells were then stimulated with LPS. 48 hours post Nucleofection, cells were analyzed by light (A) and fluorescence microscopy (B).

### Ordering Information – Kits

Cat. No. NA	Cat. No. EU	Product Name	Product Description	Size
<b>4D-Nucleofector™ Kits</b>				
V4XP-4012	V4XP-4012	P4 Primary Cell 4D-Nucleofector™ X Kit L	100 µL Nucleocuvette™ Vessel	12 reactions
V4XP-4024	V4XP-4024	P4 Primary Cell 4D-Nucleofector™ X Kit L	100 µL Nucleocuvette™ Vessel	24 reactions
V4XP-4032	V4XP-4032	P4 Primary Cell 4D-Nucleofector™ X Kit S	20 µL Nucleocuvette™ Strip	32 reactions (16-well)
<b>96-well Shuttle™ Kits</b>				
V4SP-4096	V4SP-4096	P4 Primary Cell 96-well Nucleofector™ Kit	20 µL Nucleocuvette™ Plate	96 reactions (96-well)
V4SP-4960	V4SP-4960	P4 Primary Cell 96-well Nucleofector™ Kit	20 µL Nucleocuvette™ Plate	960 reactions (96-well)
<b>384-well Nucleofector™ Kits</b>				
V5SP-4002	V5SP-4002	P4 Primary Cell 384-well Nucleofector™ Kit	20 µL Nucleocuvette™ Plate	768 reactions (384-well)
V5SP-4010	V5SP-4010	P4 Primary Cell 384-well Nucleofector™ Kit	20 µL Nucleocuvette™ Plate	3840 reactions (384-well)
<b>Nucleofector™ II/2b Kits</b>				
VAPA-1010	VAPA-1010	Mouse B Cell Nucleofector™ II/ 2b Kit	100 µL aluminum cuvette	10 reactions
VPA-1010	VPA-1010	Mouse B Cell Nucleofector™ II/ 2b Kit	100 µL aluminum cuvette	25 reactions
VVPA-1010	VVPA-1010	Mouse B Cell Nucleofector™ II/ 2b Kit	100 µL aluminum cuvette	4 × 25 reactions

Related Products	Page
RPMI 1640 without L-Glutamine	131

## Nucleofector™ Kits for Human Dendritic Cells

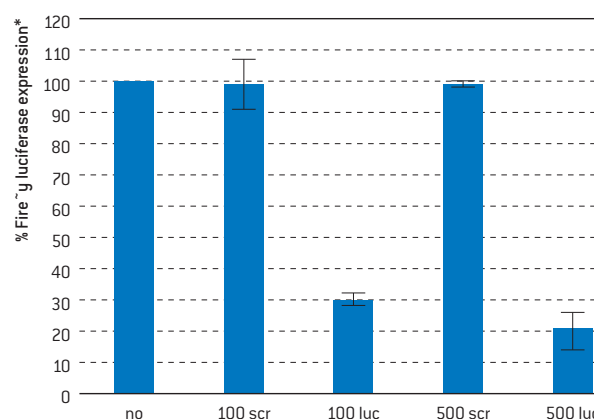
Various Nucleofector™ Kits and corresponding Optimized Protocols are available for the transfection of human dendritic cells using the different Nucleofection Platforms. Optimal kits for transfection of human dendritic cells in the 4D-Nucleofector™, 96-well Shuttle™ or 384-well Nucleofector™ System are the P3 Primary Cell Kits used in combination with cell-type specific protocols. Human dendritic cell specific kits are available for the Nucleofector™ II/2b Device.

### ■ Benefits

- Transfection efficiency: up to 87%
- Viability: up to 71%
- Same transfection conditions with different substrates, such as RNA, DNA or siRNA

### ■ Applications

- Kit suitable for immature and mature monocyte-derived dendritic cells
- For short term expression of up to 48 hours



**Co-transfection of human DCs with plasmid and siRNA.** Cells were transfected by Nucleofection with a CMV promoter driven firefly luciferase vector (pCMV-Luc), TK-promoter driven Renilla luciferase vector (pTK-Luc) as internal control reporter for normalization, and siRNA against firefly luciferase (luc) or scrambled control (scr). 24 hours post Nucleofection, cells were analyzed for luciferase activity. [Data reproduced from Stallwood *et al.* (2006) *J Immunol* 177(2):885-895, with permission of the authors].

\*Normalized to Renilla luciferase as internal control reporter

### Ordering Information – Kits

Cat. No. NA	Cat. No. EU	Product Name	Product Description	Size
<b>4D-Nucleofector™ Kits</b>				
V4XP-3012	V4XP-3012	P3 Primary Cell 4D-Nucleofector™ X Kit L	100 µL Nucleocuvette™ Vessel	12 reactions
V4XP-3024	V4XP-3024	P3 Primary Cell 4D-Nucleofector™ X Kit L	100 µL Nucleocuvette™ Vessel	24 reactions
V4XP-3032	V4XP-3032	P3 Primary Cell 4D-Nucleofector™ X Kit S	20 µL Nucleocuvette™ Strip	32 reactions (16-well)
<b>96-well Shuttle™ Kits</b>				
V4SP-3096	V4SP-3096	P3 Primary Cell 96-well Nucleofector™ Kit	20 µL Nucleocuvette™ Plate	96 reactions (96-well)
V4SP-3960	V4SP-3960	P3 Primary Cell 96-well Nucleofector™ Kit	20 µL Nucleocuvette™ Plate	960 reactions (96-well)
<b>384-well Nucleofector™ Kits</b>				
V5SP-3002	V5SP-3002	P3 Primary Cell 384-well Nucleofector™ Kit	20 µL Nucleocuvette™ Plate	768 reactions (384-well)
V5SP-3010	V5SP-3010	P3 Primary Cell 384-well Nucleofector™ Kit	20 µL Nucleocuvette™ Plate	3840 reactions (384-well)
<b>Nucleofector™ II/2b Kits</b>				
VAPA-1004	VAPA-1004	Human Dendritic Cell Nucleofector™ II/ 2b Kit	100 µL aluminum cuvette	10 reactions
VPA-1004	VPA-1004	Human Dendritic Cell Nucleofector™ II/ 2b Kit	100 µL aluminum cuvette	25 reactions
VPVA-1004	VPVA-1004	Human Dendritic Cell Nucleofector™ II/ 2b Kit	100 µL aluminum cuvette	4 × 25 reactions

Related Products	Page
RPMI 1640 without L-Glutamine	131
LGM™ 3 Lymphocyte Growth Medium-3	102 - 106
Normal Human Dendritic Cells	106

## Nucleofector™ Kits for Mouse Dendritic Cells

Various Nucleofector™ Kits and corresponding Optimized Protocols are available for the transfection of mouse dendritic cells (DCs) using the different Nucleofection Platforms.

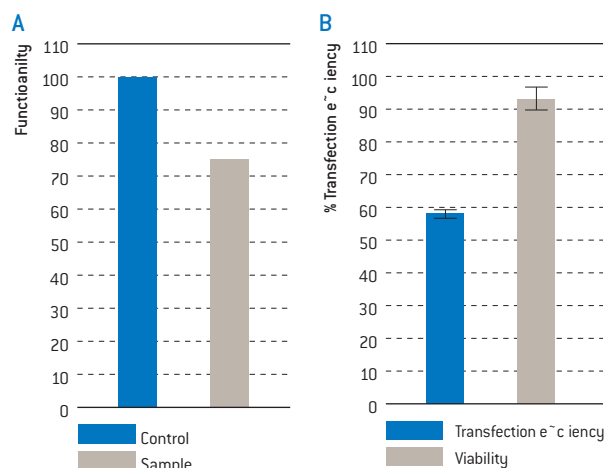
Optimal kits for transfection of mouse dendritic cells in the 4D-Nucleofector™, 96-well Shuttle™ or 384-well Nucleofector™ System are the P3 Primary Cell Kits (for mature DCs) and P4 Primary Cell Kits (for immature DCs) used in combination with cell-type specific protocols. Mouse dendritic cell specific kits are available for the Nucleofector™ II/2b Device.

### ■ Benefits

- Transfection efficiency: up to 58%
- Viability: up to 88%

### ■ Applications

- Kits suitable for Balb/C or C57BL/6 mouse DCs
- Proven results for immature and mature mouse DCs
- Ideal for gene over-expression studies or RNAi mediated gene silencing



**Transfection efficiency and functionality of mouse DCs post Nucleofection.** (A) The graph displays functionality of immature mouse DCs (isolated from mouse strain Balb/C) post Nucleofection [Sample]. Two hours post Nucleofection, cells were stimulated by LPS. 22 hours later, functionality was analyzed by IL-6 specific ELISA and is given in percent compared to non-transfected control. (B) Mouse DC (Balb/C) were transfected using pmaxGFP™ Vector. Cells were analyzed 24 hours post Nucleofection by flow cytometry for maxGFP™ Reporter Protein expression and viability. Cell viability is given in percent compared to non-transfected control.

### Ordering Information – Kits

Cat. No. NA	Cat. No. EU	Product Name	Product Description	Size
<b>4D-Nucleofector™ Kits</b>				
V4XP-3012	V4XP-3012	P3 Primary Cell 4D-Nucleofector™ X Kit L*	100 µL Nucleocuvette™ Vessel	12 reactions
V4XP-3024	V4XP-3024	P3 Primary Cell 4D-Nucleofector™ X Kit L*	100 µL Nucleocuvette™ Vessel	24 reactions
V4XP-3032	V4XP-3032	P3 Primary Cell 4D-Nucleofector™ X Kit S*	20 µL Nucleocuvette™ Strip	32 reactions (16-well)
V4XP-4012	V4XP-4012	P4 Primary Cell 4D-Nucleofector™ X Kit L**	100 µL Nucleocuvette™ Vessel	12 reactions
V4XP-4024	V4XP-4024	P4 Primary Cell 4D-Nucleofector™ X Kit L**	100 µL Nucleocuvette™ Vessel	24 reactions
V4XP-4032	V4XP-4032	P4 Primary Cell 4D-Nucleofector™ X Kit S**	20 µL Nucleocuvette™ Strip	32 reactions (16-well)
<b>96-well Shuttle™ Kits</b>				
V4SP-3096	V4SP-3096	P3 Primary Cell 96-well Nucleofector™ Kit*	20 µL Nucleocuvette™ Plate	96 reactions (96-well)
V4SP-3960	V4SP-3960	P3 Primary Cell 96-well Nucleofector™ Kit*	20 µL Nucleocuvette™ Plate	960 reactions (96-well)
V4SP-4096	V4SP-4096	P4 Primary Cell 96-well Nucleofector™ Kit**	20 µL Nucleocuvette™ Plate	96 reactions (96-well)
V4SP-4960	V4SP-4960	P4 Primary Cell 96-well Nucleofector™ Kit**	20 µL Nucleocuvette™ Plate	960 reactions (96-well)
<b>384-well Nucleofector™ Kits</b>				
V5SP-3002	V5SP-3002	P3 Primary Cell 384-well Nucleofector™ Kit*	20 µL Nucleocuvette™ Plate	768 reactions (384-well)
V5SP-3010	V5SP-3010	P3 Primary Cell 384-well Nucleofector™ Kit*	20 µL Nucleocuvette™ Plate	3840 reactions (384-well)
V5SP-4002	V5SP-4002	P4 Primary Cell 384-well Nucleofector™ Kit**	20 µL Nucleocuvette™ Plate	768 reactions (384-well)
V5SP-4010	V5SP-4010	P4 Primary Cell 384-well Nucleofector™ Kit**	20 µL Nucleocuvette™ Plate	3840 reactions (384-well)
<b>Nucleofector™ II/2b Kits</b>				
VAPA-1011	VAPA-1011	Mouse Dendritic Cell Nucleofector™ II/ 2b Kit	100 µL aluminum cuvette	10 reactions
VPA-1011	VPA-1011	Mouse Dendritic Cell Nucleofector™ II/ 2b Kit	100 µL aluminum cuvette	25 reactions
VVPA-1011	VVPA-1011	Mouse Dendritic Cell Nucleofector™ II/ 2b Kit	100 µL aluminum cuvette	4 × 25 reactions

\*For mature Mouse DCs \*\*For immature Mouse DCs

## Nucleofector™ Kits for Human Macrophages

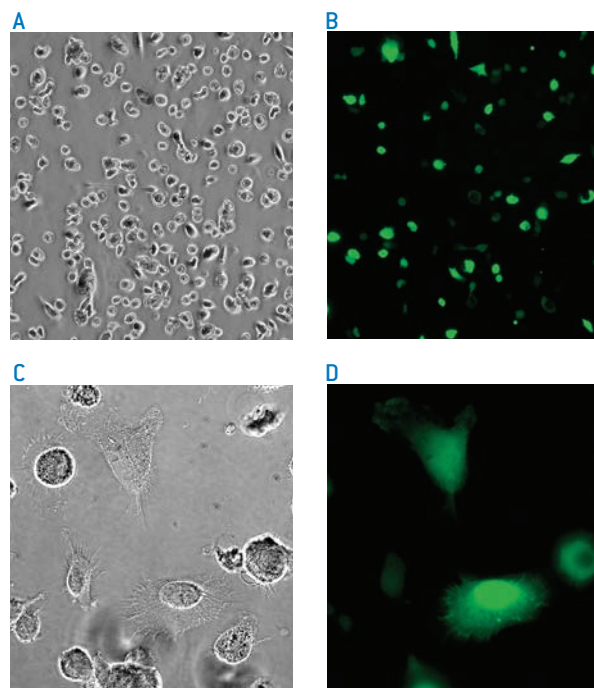
Various Nucleofector™ Kits and corresponding Optimized Protocols are available for the transfection of human macrophages using the different Nucleofection Platforms. Optimal kits for transfection of human macrophages in the 4D-Nucleofector™, 96-well Shuttle™ or 384-well Nucleofector™ System are the P3 Primary Cell Kits used in combination with cell-type specific protocols. Human macrophage specific kits are available for the Nucleofector™ II/2b Device.

### ■ Benefits

- Transfection efficiency: up to 59%
- Viability: up to 88%
- Maintenance of functionality (e.g. activation)

### ■ Applications

- Kits suitable for resting human macrophages
- Cited for DNA and siRNA transfection
- High-throughput screening approaches possible



**Nucleofection of human macrophages.** Primary human macrophages were transfected by Nucleofection with pmaxGFP™ Control Vector. 24 hours post Nucleofection, cells were analyzed for maxGFP™ Reporter Protein expression by light [A, C] and fluorescence [B, D] microscopy. A and B show cells at 10x magnification. At 40x magnification [C, D] transfected macrophages reveal cytoplasmic extrusions important for phagocytic function of macrophages.

### Ordering Information – Kits

Cat. No. NA	Cat. No. EU	Product Name	Product Description	Size
<b>4D-Nucleofector™ Kits</b>				
V4XP-3012	V4XP-3012	P3 Primary Cell 4D-Nucleofector™ X Kit L	100 µL Nucleocuvette™ Vessel	12 reactions
V4XP-3024	V4XP-3024	P3 Primary Cell 4D-Nucleofector™ X Kit L	100 µL Nucleocuvette™ Vessel	24 reactions
V4XP-3032	V4XP-3032	P3 Primary Cell 4D-Nucleofector™ X Kit S	20 µL Nucleocuvette™ Strip	32 reactions (16-well)
<b>96-well Shuttle™ Kits</b>				
V4SP-3096	V4SP-3096	P3 Primary Cell 96-well Nucleofector™ Kit	20 µL Nucleocuvette™ Plate	96 reactions (96-well)
V4SP-3960	V4SP-3960	P3 Primary Cell 96-well Nucleofector™ Kit	20 µL Nucleocuvette™ Plate	960 reactions (96-well)
<b>384-well Nucleofector™ Kits</b>				
V5SP-3002	V5SP-3002	P3 Primary Cell 384-well Nucleofector™ Kit	20 µL Nucleocuvette™ Plate	768 reactions (384-well)
V5SP-3010	V5SP-3010	P3 Primary Cell 384-well Nucleofector™ Kit	20 µL Nucleocuvette™ Plate	3840 reactions (384-well)
<b>Nucleofector™ II/2b Kits</b>				
VAPA-1008	VAPA-1008	Human Macrophage Nucleofector™ II/ 2b Kit	100 µL aluminum cuvette	10 reactions
VPA-1008	VPA-1008	Human Macrophage Nucleofector™ II/ 2b Kit	100 µL aluminum cuvette	25 reactions
VVPA-1008	VVPA-1008	Human Macrophage Nucleofector™ II/ 2b Kit	100 µL aluminum cuvette	4 × 25 reactions

Related Products	Page
RPMI 1640 without L-Glutamine	131

## Nucleofector™ Kits for Mouse Macrophages

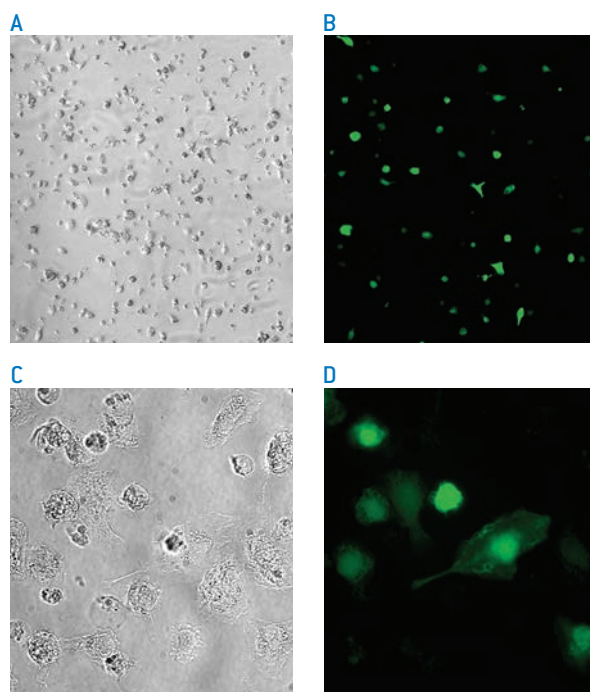
Various Nucleofector™ Kits and corresponding Optimized Protocols are available for the transfection of mouse macrophages using the different Nucleofection Platforms. Optimal kits for transfection of mouse macrophages in the 4D-Nucleofector™, 96-well Shuttle™ or 384-well Nucleofector™ System are the P2 Primary Cell Kits used in combination with cell-type specific protocols. Mouse macrophage specific kits are available for the Nucleofector™ II/2b Device.

### ■ Benefits

- Transfection efficiency: up to 47%
- Viability: up to 92%
- Maintenance of functionality (e.g. activation)

### ■ Applications

- Kits suitable for resting bone marrow-derived mouse macrophages
- Evaluated for C57BL/6 and BALB/c strains
- Enabling studies of gene regulation, signaling pathways or differentiation



**Nucleofection of mouse macrophages with pmaxGFP™ Vector.** Primary mouse macrophages were transfected by Nucleofection with a plasmid encoding maxGFP™ Reporter Protein. 24 hours post Nucleofection, cells were analyzed by light [A, C] and fluorescence microscopy [B, D]. A and B show cells at 10 × magnification. At 40 × magnification [C, D], transfected macrophages reveal cytoplasmic extrusions important for phagocytic function.

### Ordering Information – Kits

Cat. No. NA	Cat. No. EU	Product Name	Product Description	Size
<b>4D-Nucleofector™ Kits</b>				
V4XP-2012	V4XP-2012	P2 Primary Cell 4D-Nucleofector™ X Kit L	100 µL Nucleocuvette™ Vessel	12 reactions
V4XP-2024	V4XP-2024	P2 Primary Cell 4D-Nucleofector™ X Kit L	100 µL Nucleocuvette™ Vessel	24 reactions
V4XP-2032	V4XP-2032	P2 Primary Cell 4D-Nucleofector™ X Kit S	20 µL Nucleocuvette™ Strip	32 reactions [16-well]
<b>96-well Shuttle™ Kits</b>				
V4SP-2096	V4SP-2096	P2 Primary Cell 96-well Nucleofector™ Kit	20 µL Nucleocuvette™ Plate	96 reactions [96-well]
V4SP-2960	V4SP-2960	P2 Primary Cell 96-well Nucleofector™ Kit	20 µL Nucleocuvette™ Plate	960 reactions [96-well]
<b>384-well Nucleofector™ Kits</b>				
V5SP-2002	V5SP-2002	P2 Primary Cell 384-well Nucleofector™ Kit	20 µL Nucleocuvette™ Plate	768 reactions [384-well]
V5SP-2010	V5SP-2010	P2 Primary Cell 384-well Nucleofector™ Kit	20 µL Nucleocuvette™ Plate	3840 reactions [384-well]
<b>Nucleofector™ II/2b Kits</b>				
VAPA-1009	VAPA-1009	Mouse Macrophage Nucleofector™ II/ 2b Kit	100 µL aluminum cuvette	10 reactions
VPA-1009	VPA-1009	Mouse Macrophage Nucleofector™ II/ 2b Kit	100 µL aluminum cuvette	25 reactions
WVPA-1009	WVPA-1009	Mouse Macrophage Nucleofector™ II/ 2b Kit	100 µL aluminum cuvette	4 × 25 reactions

Related Products	Page
DMEM 4.5 g/L glucose with L-Glutamine	124
RPMI 1640 without L-Glutamine	131

## Nucleofector™ Kits for Human Monocytes

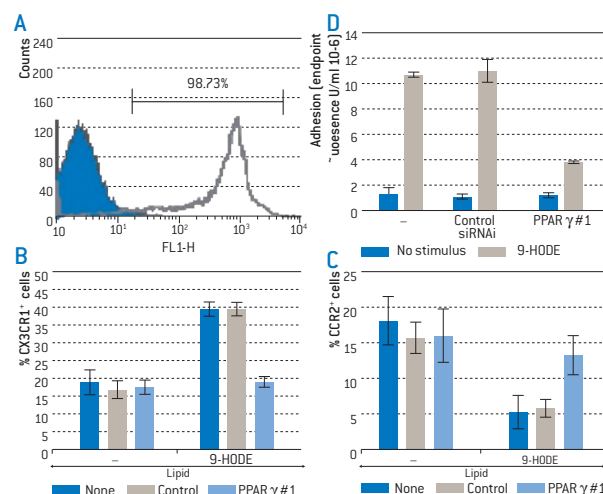
Various Nucleofector™ Kits and corresponding Optimized Protocols are available for the transfection of human monocytes using the different Nucleofection Platforms. Optimal kits for transfection of human monocytes in the 4D-Nucleofector™, 96-well Shuttle™ or 384-well Nucleofector™ System are the P3 Primary Cell Kits used in combination with cell-type specific protocols. Human monocyte specific kits are available for the Nucleofector™ II/2b Device.

### Benefits

- Transfection efficiency: up to 64%
- Viability: up to 81%
- First high-throughput transfection technology for human monocytes

### Applications

- Kits suitable for CD14<sup>+</sup> human monocytes
- Cited for DNA and siRNA transfections



**Nucleofection™ of human monocytes with Stealth™ siRNA.** (A) Efficiency of transfection was determined with 100 nM fluorescein-labeled dsRNA oligomer [same length, electrical charge and configuration as the siRNA] monitored 24 hours later by flow cytometry. Blue curve shows autofluorescence. (B, C and D) Knockdown with Stealth™ siRNA (Invitrogen). Oxidized linoleic acid metabolites [like 9-HODE, 9-hydroxy-10E, 12Z-octadecadienoic acid ester], components of oxidized LDL found in large amounts in atherosclerotic plaque, are able to specifically induce differentiation of human monocytes to macrophages accompanied by a switch of chemokine receptor expression (CCR2-off and CX3CR1-on). CX3CR1 then mediates macrophage adhesion to coronary artery smooth muscle cells (CASMCS). The effects of the lipids on receptor expression are mediated by the nuclear receptor peroxisome proliferator-activated receptor (PPAR)γ. Down regulation of PPARγ with siRNA (200 nM, [Invitrogen]) dramatically reduced receptor switch (B and C) and consequently macrophage adhesion to CASMCs in an adhesion assay (D). [Data extracted from Barlic et al., (2006) Circulation 114(8), 807-19 with permission from the authors.]

### Ordering Information – Kits

Cat. No. NA	Cat. No. EU	Product Name	Product Description	Size
<b>4D-Nucleofector™ Kits</b>				
V4XP-3012	V4XP-3012	P3 Primary Cell 4D-Nucleofector™ X Kit L	100 µL Nucleocuvette™ Vessel	12 reactions
V4XP-3024	V4XP-3024	P3 Primary Cell 4D-Nucleofector™ X Kit L	100 µL Nucleocuvette™ Vessel	24 reactions
V4XP-3032	V4XP-3032	P3 Primary Cell 4D-Nucleofector™ X Kit S	20 µL Nucleocuvette™ Strip	32 reactions (16-well)
<b>96-well Shuttle™ Kits</b>				
V4SP-3096	V4SP-3096	P3 Primary Cell 96-well Nucleofector™ Kit	20 µL Nucleocuvette™ Plate	96 reactions (96-well)
V4SP-3960	V4SP-3960	P3 Primary Cell 96-well Nucleofector™ Kit	20 µL Nucleocuvette™ Plate	960 reactions (96-well)
<b>384-well Nucleofector™ Kits</b>				
V5SP-3002	V5SP-3002	P3 Primary Cell 384-well Nucleofector™ Kit	20 µL Nucleocuvette™ Plate	768 reactions (384-well)
V5SP-3010	V5SP-3010	P3 Primary Cell 384-well Nucleofector™ Kit	20 µL Nucleocuvette™ Plate	3840 reactions (384-well)
<b>Nucleofector™ II/2b Kits</b>				
VPA-1007	VPA-1007	Human Monocyte Nucleofector™ II/ 2b Kit	100 µL aluminum cuvette	25 reactions
WPA-1007	WPA-1007	Human Monocyte Nucleofector™ II/ 2b Kit	100 µL aluminum cuvette	4 × 25 reactions

### Related Products

	Page
LGM™ 3 Lymphocyte Growth Medium-3	102 - 106
Human CD14 <sup>+</sup> Monocytes	106



## Nucleofector™ Kits for Human Natural Killer Cells

Various Nucleofector™ Kits and corresponding Optimized Protocols are available for the transfection of human NK cells using the different Nucleofection Platforms.

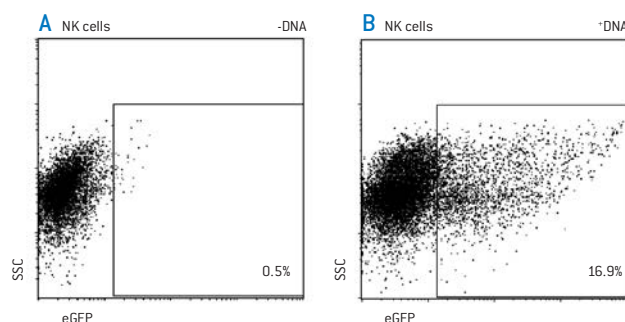
For the transfection of human NK cells in the 4D-Nucleofector™, 96-well Shuttle™ or 384-well Nucleofector™ System we recommend using the Primary Cell Optimization Kits and the respective optimization protocols. Optimal Nucleofection Conditions are transferable between these three systems. Human NK cell specific kits are available for the Nucleofector™ II/2b Device.

### ■ Benefits

- Transfection efficiency: up to 54%
- Viability: up to 60%
- Efficient non-viral transfection technology for primary NK cells

### ■ Applications

- Kits suitable for human CD56<sup>+</sup>/CD3<sup>+</sup> natural killer cells



**Nucleofection of primary human NK cells.** Polyclonal human NK cells generated from PBMC co-cultured with the feeder cell line RPMI 8866 for 9 days were transfected by Nucleofection with a plasmid encoding eGFP protein. Cells were analyzed by flow cytometry 24 hours post Nucleofection. eGFP expression in natural killer cells is shown after Nucleofection without (A) and with plasmid DNA (B). [Courtesy of J. Sundback and K. Karre, Karolinska Institute, Microbiology and Tumor Biology Center, Stockholm, Sweden.]

### Ordering Information – Kits

Cat. No. NA	Cat. No. EU	Product Name	Product Description	Size
<b>4D-Nucleofector™ Kits</b>				
V4XP-9096	V4XP-9096	Primary Cell Optimization 4D-Nucleofector™ X Kit	20 µL Nucleocuvette™ Strip	96 reactions (16-well)
<b>96-well Shuttle™ Kits</b>				
V4SP-9096	V4SP-9096	Primary Cell Optimization 96-well Nucleofector™ Kit	20 µL Nucleocuvette™ Plate	160 reactions (96-well)
<b>384-well Nucleofector™ Kits</b>				
V5SP-9001	V5SP-9001	Primary Cell Optimization 384-well Nucleofector™ Kit	20 µL Nucleocuvette™ Plate	384 reactions (384-well)
<b>Nucleofector™ II/2b Kits</b>				
VAPA-1005	VAPA-1005	Human Natural Killer Cell Nucleofector™ II/ 2b Kit	100 µL aluminum cuvette	10 reactions
VPA-1005	VPA-1005	Human Natural Killer Cell Nucleofector™ II/ 2b Kit	100 µL aluminum cuvette	25 reactions
VVPA-1005	VVPA-1005	Human Natural Killer Cell Nucleofector™ II/ 2b Kit	100 µL aluminum cuvette	4 × 25 reactions

Related Products	Page
LGM™ 3 Lymphocyte Growth Medium-3	102 - 106
RPMI 1640 without L-Glutamine	131
Human NK Cells	106



## Nucleofector™ Kits for Human T Cells

Various Nucleofector™ Kits and corresponding Optimized Protocols are available for the transfection of human T cells using the different Nucleofection Platforms.

Optimal kits for transfection of human T cells in the 4D-Nucleofector™, 96-well Shuttle™ or 384-well Nucleofector™ System are the P3 Primary Cell Kits used in combination with cell-type specific protocols. Human T cell specific kits are available for the Nucleofector™ II/2b Device.

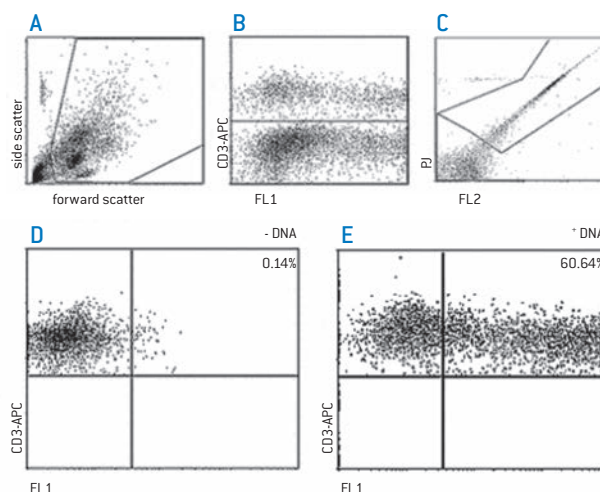
### ■ Benefits

- Transfection efficiency: up to 87%
- Viability: up to 90%
- Transfected cells preserve their biochemical functionality
- More than 270 publications on T cell Nucleofection

### ■ Applications

- Kits suitable for stimulated and unstimulated human T cells
- RNAi screenings in primary T cells for basic and pharmaceutical research

 [www.lonza.com/citations](http://www.lonza.com/citations)



**Nucleofection™ of human T cells with pmxGFP™ Vector.** PBMC were freshly isolated from a buffy coat and transfected by Nucleofection with pmxGFP™ Vector. 24 hours post Nucleofection, cells were analyzed by flow cytometry. Lymphocytes were gated according to forward/side scatter (A). T cells were stained with antibody directed against CD3. Dead cells were excluded by propidium iodide staining and gating (B, C). maxGFP™ Reporter Protein expression of T cells is shown after Nucleofection without (D) and with plasmid DNA (E).

### Ordering Information – Kits

Cat. No. NA	Cat. No. EU	Product Name	Product Description	Size
<b>4D-Nucleofector™ Kits</b>				
V4XP-3012	V4XP-3012	P3 Primary Cell 4D-Nucleofector™ X Kit L	100 µL Nucleocuvette™ Vessel	12 reactions
V4XP-3024	V4XP-3024	P3 Primary Cell 4D-Nucleofector™ X Kit L	100 µL Nucleocuvette™ Vessel	24 reactions
V4XP-3032	V4XP-3032	P3 Primary Cell 4D-Nucleofector™ X Kit S	20 µL Nucleocuvette™ Strip	32 reactions (16-well)
<b>96-well Shuttle™ Kits</b>				
V4SP-3096	V4SP-3096	P3 Primary Cell 96-well Nucleofector™ Kit	20 µL Nucleocuvette™ Plate	96 reactions (96-well)
V4SP-3960	V4SP-3960	P3 Primary Cell 96-well Nucleofector™ Kit	20 µL Nucleocuvette™ Plate	960 reactions (96-well)
<b>384-well Nucleofector™ Kits</b>				
V5SP-3002	V5SP-3002	P3 Primary Cell 384-well Nucleofector™ Kit	20 µL Nucleocuvette™ Plate	768 reactions (384-well)
V5SP-3010	V5SP-3010	P3 Primary Cell 384-well Nucleofector™ Kit	20 µL Nucleocuvette™ Plate	3840 reactions (384-well)
<b>Nucleofector™ II/2b Kits</b>				
VAPA-1002	VAPA-1002	Human T Cell Nucleofector™ II/ 2b Kit	100 µL aluminum cuvette	10 reactions
VPA-1002	VPA-1002	Human T Cell Nucleofector™ II/ 2b Kit	100 µL aluminum cuvette	25 reactions
WVPA-1002	WVPA-1002	Human T Cell Nucleofector™ II/ 2b Kit	100 µL aluminum cuvette	4 × 25 reactions

Related Products	Page
LGM™ 3 Lymphocyte Growth Medium-3	102 - 106
IMDM with HEPES and L-Glutamine	127
Human CD4 <sup>+</sup> T Cells	106
HPBMC - Human Peripheral Blood Mononuclear Cells	106

## Nucleofector™ Kits for Mouse T Cells

Various Nucleofector™ Kits and corresponding Optimized Protocols are available for the transfection of mouse T cells using the different Nucleofection Platforms.

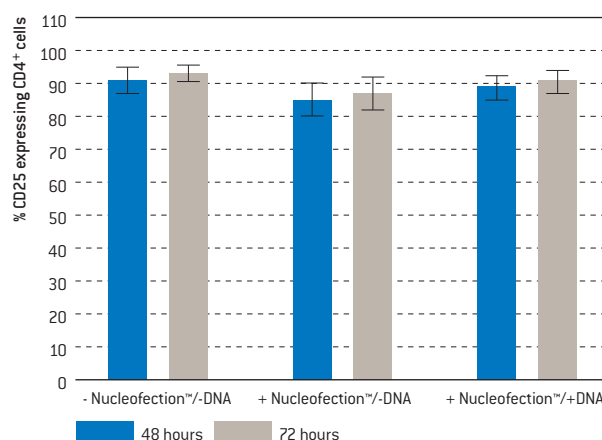
Optimal kits for transfection of mouse T cells in the 4D-Nucleofector™, 96-well Shuttle™ or 384-well Nucleofector™ System are the P3 Primary Cell Kits used in combination with cell-type specific protocols. Mouse T cell specific kits are available for the Nucleofector™ II/2b Device.

### ■ Benefits

- Transfection efficiency: up to 45%
- Viability: up to 55%
- Evaluated for C57BL/6 and BALB/c strains
- Maintenance of functionality, e.g. stimulation

### ■ Applications

- Kits suitable for mouse T cells from C57BL/6 or BALB/c
- Overexpression or gene silencing studies possible in high-throughput frameworks



Transfected and non-transfected mouse T cells can be stimulated equally well. Primary C57BL/6 mouse T cells were transfected using Nucleofection with pmaxGFP™ Vector. 3 hours post Nucleofection, cells were stimulated with plate bound anti-CD3 and anti-CD28. 48 and 72 hours post Nucleofection, CD4+ cells were analyzed for CD25 surface expression. Figure shows proportion of CD25-expressing cells among living CD4+ T cells (%CD25 expression in unstimulated samples ranged from 10–20%).

### Ordering Information – Kits

Cat. No. NA	Cat. No. EU	Product Name	Product Description	Size
<b>4D-Nucleofector™ Kits</b>				
V4XP-3012	V4XP-3012	P3 Primary Cell 4D-Nucleofector™ X Kit L	100 µL Nucleocuvette™ Vessel	12 reactions
V4XP-3024	V4XP-3024	P3 Primary Cell 4D-Nucleofector™ X Kit L	100 µL Nucleocuvette™ Vessel	24 reactions
V4XP-3032	V4XP-3032	P3 Primary Cell 4D-Nucleofector™ X Kit S	20 µL Nucleocuvette™ Strip	32 reactions (16-well)
<b>96-well Shuttle™ Kits</b>				
V4SP-3096	V4SP-3096	P3 Primary Cell 96-well Nucleofector™ Kit	20 µL Nucleocuvette™ Plate	96 reactions (96-well)
V4SP-3960	V4SP-3960	P3 Primary Cell 96-well Nucleofector™ Kit	20 µL Nucleocuvette™ Plate	960 reactions (96-well)
<b>384-well Nucleofector™ Kits</b>				
V5SP-3002	V5SP-3002	P3 Primary Cell 384-well Nucleofector™ Kit	20 µL Nucleocuvette™ Plate	768 reactions (384-well)
V5SP-3010	V5SP-3010	P3 Primary Cell 384-well Nucleofector™ Kit	20 µL Nucleocuvette™ Plate	3840 reactions (384-well)
<b>Nucleofector™ II/2b Kits</b>				
VPA-1006	VPA-1006	Mouse T Cell Nucleofector™ II/ 2b Kit	100 µL aluminum cuvette	25 reactions
VVPA-1006	VVPA-1006	Mouse T Cell Nucleofector™ II/ 2b Kit	100 µL aluminum cuvette	4 × 25 reactions

Related Products	Page
Mouse T Cell Nucleofector™ Medium	262

## Nucleofector™ Kits for Mammalian Blood Cells

For mammalian blood cells lacking a cell-type specific Optimized Protocol, we offer a selection of kits that can be used to easily define optimal Nucleofection conditions. The Primary Cell Optimization Kits are suited for optimizations of mammalian blood cells on the 4D-Nucleofector™ System, the 96-well Shuttle™ System or the 384-well Nucleofector™ System.

### ■ Benefits

- Protocols to guide you through the optimization procedure
- Optimizations can be performed within one experiment
- Optional result fine tuning with help from our Scientific Support Team

### ■ Applications

- Kits suited for blood cells from different mammalian species and various organs

### Ordering Information – Kits

Cat. No. NA	Cat. No. EU	Product Name	Product Description	Size
<b>4D-Nucleofector™ Kits</b>				
V4XP-9096	V4XP-9096	Primary Cell Optimization 4D-Nucleofector™ X Kit	20 µL Nucleocuvette™ Strip	96 reactions (16-well)
<b>96-well Shuttle™ Kits</b>				
V4SP-9096	V4SP-9096	Primary Cell Optimization 96-well Nucleofector™ Kit	20 µL Nucleocuvette™ Plate	160 reactions (96-well)
<b>384-well Nucleofector™ Kits</b>				
V5SP-9001	V5SP-9001	Primary Cell Optimization 384-well Nucleofector™ Kit	20 µL Nucleocuvette™ Plate	384 reactions (384-well)

## Nucleofector™ Kits for Human Chondrocytes

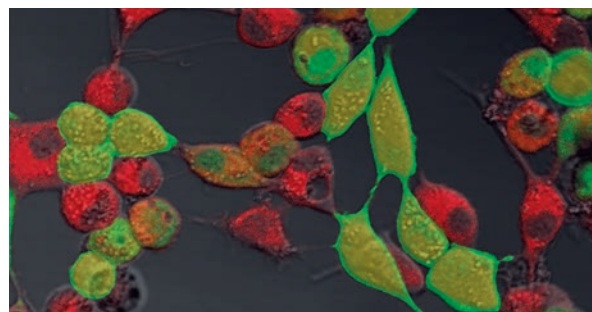
Various Nucleofector™ Kits and corresponding Optimized Protocols are available for the transfection of human chondrocytes using the different Nucleofection Platforms. Optimal kits for transfection of human chondrocytes in the 4D-Nucleofector™, 96-well Shuttle™ or 384-well Nucleofector™ System are the P3 Primary Cell Kits used in combination with cell-type specific protocols. Human chondrocyte cell specific kits are available for the Nucleofector™ II/2b Device.

### ■ Benefits

- Transfection efficiency: up to 74%
- Viability: up to 84%
- First efficient non-viral transfection technology

### ■ Applications

- Optimal for studies of degenerative processes, such as osteoarthritis



**Example of the transfection of human chondrocytes with eGFP.** Human chondrocytes were transfected by Nucleofection using a plasmid encoding the enhanced green fluorescent protein eGFP. Cell membranes were fluorescently stained in red with the substance R18 (Octadecylrhodamine-B-chloride, Molecular Probes). 24 hours post Nucleofection, the cells were analyzed by fluorescence microscopy. The image shows an overlay of eGFP and R18 fluorescence. (Data courtesy of Dr. Schmid and Dr. Aigner, University of Erlangen, Germany.)

### Ordering Information – Kits

Cat. No. NA	Cat. No. EU	Product Name	Product Description	Size
<b>4D-Nucleofector™ Kits</b>				
V4XP-3012	V4XP-3012	P3 Primary Cell 4D-Nucleofector™ X Kit L	100 µL Nucleocuvette™ Vessel	12 reactions
V4XP-3024	V4XP-3024	P3 Primary Cell 4D-Nucleofector™ X Kit L	100 µL Nucleocuvette™ Vessel	24 reactions
V4XP-3032	V4XP-3032	P3 Primary Cell 4D-Nucleofector™ X Kit S	20 µL Nucleocuvette™ Strip	32 reactions (16-well)
<b>96-well Shuttle™ Kits</b>				
V4SP-3096	V4SP-3096	P3 Primary Cell 96-well Nucleofector™ Kit	20 µL Nucleocuvette™ Plate	96 reactions (96-well)
V4SP-3960	V4SP-3960	P3 Primary Cell 96-well Nucleofector™ Kit	20 µL Nucleocuvette™ Plate	960 reactions (96-well)
<b>384-well Nucleofector™ Kits</b>				
V5SP-3002	V5SP-3002	P3 Primary Cell 384-well Nucleofector™ Kit	20 µL Nucleocuvette™ Plate	768 reactions (384-well)
V5SP-3010	V5SP-3010	P3 Primary Cell 384-well Nucleofector™ Kit	20 µL Nucleocuvette™ Plate	3840 reactions (384-well)
<b>Nucleofector™ II/2b Kits</b>				
VPF-1001	VPF-1001	Human Chondrocyte Nucleofector™ II/ 2b Kit	100 µL aluminum cuvette	25 reactions
VVPF-1001	VVPF-1001	Human Chondrocyte Nucleofector™ II/ 2b Kit	100 µL aluminum cuvette	4 × 25 reactions

Related Products	Page
Human Chondrocytes	84
CGM™ Chondrocyte Growth Medium	85
CGM™ Chondrocyte Differentiation Medium	85

## Nucleofector™ Kits for Rat Cardiomyocytes

Various Nucleofector™ Kits and corresponding Optimized Protocols are available for the transfection of rat cardiomyocytes using the different Nucleofection Platforms.

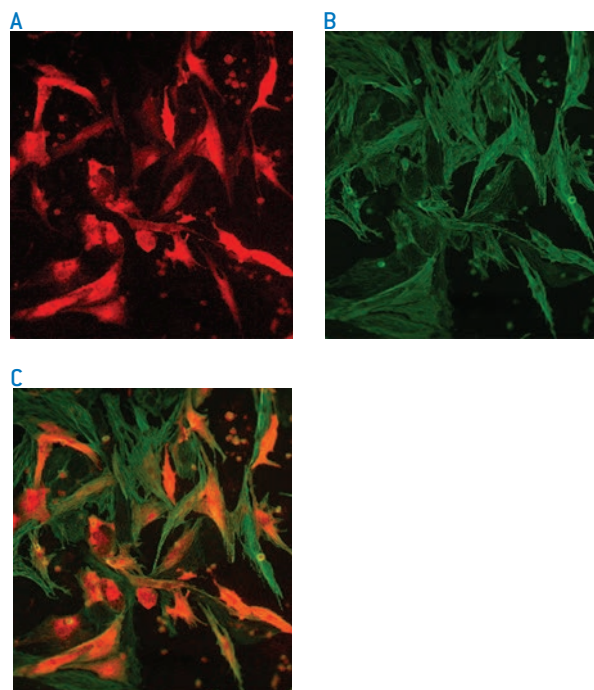
For the transfection of rat cardiomyocytes in the 4D-Nucleofector™, 96-well Shuttle™ or 384-well Nucleofector™ System we recommend using the Primary Cell Optimization Kits and the respective optimization protocols. Optimal Nucleofection Conditions are transferable between these three systems. Rat cardiomyocyte specific kits are available for the Nucleofector™ II/2b Device.

### ■ Benefits

- Transfection efficiency: up to 80%
- Viability: up to 60%
- First efficient non-viral transfection technology

### ■ Applications

- Kit suitable for neonatal rat cardiomyocytes
- Optimal for studies of cardiac gene regulation and differentiation



Example for Nucleofection of neonatal rat cardiomyocytes with DsRed2 cDNA. Primary neonatal rat cardiomyocytes were transfected by Nucleofection using a plasmid encoding DsRed (Clontech). 2 days post Nucleofection, the cells were analyzed by fluorescence microscopy. Fig. (A) shows DsRed expressing cells. Cardiomyocytes stained with FITC-labeled tropomyosin antibody are shown in Fig. (B). Fig. (C) is an overlay of images (A) and (B). [Photograph courtesy of F. Engel and M. Keating, Cardiology Department, Children's Hospital, Harvard Medical School, Boston, Massachusetts, USA.]

### Ordering Information – Kits

Cat. No. NA	Cat. No. EU	Product Name	Product Description	Size
<b>4D-Nucleofector™ Kits</b>				
V4XP-9096	V4XP-9096	Primary Cell Optimization 4D-Nucleofector™ X Kit	20 µL Nucleocuvette™ Strip	96 reactions (16-well)
<b>96-well Shuttle™ Kits</b>				
V4SP-9096	V4SP-9096	Primary Cell Optimization 96-well Nucleofector™ Kit	20 µL Nucleocuvette™ Plate	160 reactions (96-well)
<b>384-well Nucleofector™ Kits</b>				
V5SP-9001	V5SP-9001	Primary Cell Optimization 384-well Nucleofector™ Kit	20 µL Nucleocuvette™ Plate	384 reactions (384-well)
<b>Nucleofector™ II/ 2b Kits</b>				
VAPE-1002	VAPE-1002	Rat Cardiomyocyte - Neonatal Nucleofector™ II/ 2b Kit	100 µL aluminum cuvette	10 reactions
VPE-1002	VPE-1002	Rat Cardiomyocyte - Neonatal Nucleofector™ II/ 2b Kit	100 µL aluminum cuvette	25 reactions
VVPE-1002	VVPE-1002	Rat Cardiomyocyte - Neonatal Nucleofector™ II/ 2b Kit	100 µL aluminum cuvette	4 × 25 reactions

Related Products	Page
Rat Cardiac Myocytes	92
RCGM – Rat Cardiac Growth Myocytes BulletKit™	92

## Nucleofector™ Kits for Human Keratinocytes (NHEK)

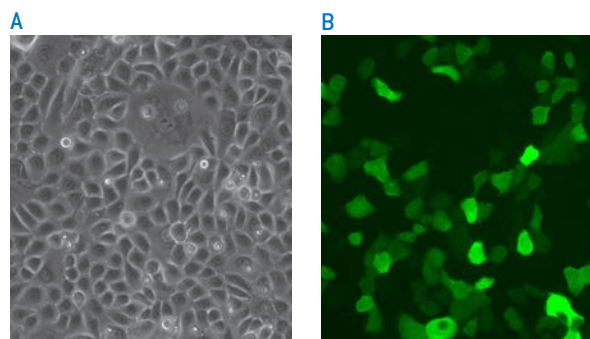
Various Nucleofector™ Kits and corresponding Optimized Protocols are available for the transfection of human keratinocytes using the different Nucleofection Platforms. Optimal kits for transfection of human keratinocytes in the 4D-Nucleofector™, 96-well Shuttle™ or 384-well Nucleofector™ System are the P3 Primary Cell Kits used in combination with cell-type specific protocols. Human keratinocyte specific kits are available for the Nucleofector™ II/2b Device.

### ■ Benefits

- Transfection efficiency: up to 53%
- Viability: up to 60%
- Maintenance of functionality, e.g. no terminal differentiation

### ■ Applications

- Validated to work with Clonetics™ Human Keratinocytes
- Kits suitable for adult and neonatal keratinocytes
- Optimal for studying gene expression or intracellular signaling
- Cited for DNA and siRNA transfections



Example for the Nucleofection of human keratinocytes. Clonetics™ NHEK-neo were transfected by Nucleofection with pmaxGFP™ Vector. 48 hours post Nucleofection, cells were analyzed by light [A] and fluorescence microscopy [B].

 [www.lonza.com/citations](http://www.lonza.com/citations)

### Ordering Information – Kits

Cat. No. NA	Cat. No. EU	Product Name	Product Description	Size
<b>4D-Nucleofector™ Kits</b>				
V4XP-3012	V4XP-3012	P3 Primary Cell 4D-Nucleofector™ X Kit L	100 µL Nucleocuvette™ Vessel	12 reactions
V4XP-3024	V4XP-3024	P3 Primary Cell 4D-Nucleofector™ X Kit L	100 µL Nucleocuvette™ Vessel	24 reactions
V4XP-3032	V4XP-3032	P3 Primary Cell 4D-Nucleofector™ X Kit S	20 µL Nucleocuvette™ Strip	32 reactions (16-well)
<b>96-well Shuttle™ Kits</b>				
V4SP-3096	V4SP-3096	P3 Primary Cell 96-well Nucleofector™ Kit	20 µL Nucleocuvette™ Plate	96 reactions (96-well)
V4SP-3960	V4SP-3960	P3 Primary Cell 96-well Nucleofector™ Kit	20 µL Nucleocuvette™ Plate	960 reactions (96-well)
<b>384-well Nucleofector™ Kits</b>				
V5SP-3002	V5SP-3002	P3 Primary Cell 384-well Nucleofector™ Kit	20 µL Nucleocuvette™ Plate	768 reactions (384-well)
V5SP-3010	V5SP-3010	P3 Primary Cell 384-well Nucleofector™ Kit	20 µL Nucleocuvette™ Plate	3840 reactions (384-well)
<b>Nucleofector™ II/2b Kits</b>				
VAPD-1002	VAPD-1002	Human Keratinocyte Nucleofector™ II/ 2b Kit	100 µL aluminum cuvette	10 reactions
VPD-1002	VPD-1002	Human Keratinocyte Nucleofector™ II/ 2b Kit	100 µL aluminum cuvette	25 reactions
WVPD-1002	WVPD-1002	Human Keratinocyte Nucleofector™ II/ 2b Kit	100 µL aluminum cuvette	4 × 25 reactions

Related Products	Page
NHEK – Adult Normal Human Epidermal Keratinocytes	61
NHEK – Neonatal Normal Human Epidermal Keratinocytes	61
KGM™ Gold Keratinocyte Growth Medium BulletKit™	62

## Nucleofector™ Kits for Human Melanocytes (NHEM-Neo)

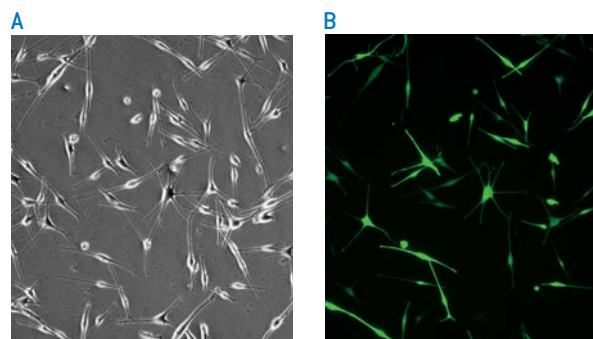
Various Nucleofector™ Kits and corresponding Optimized Protocols are available for the transfection of human melanocytes using the different Nucleofection Platforms. For the transfection of human melanocytes in the 4D-Nucleofector™, 96-well Shuttle™ or 384-well Nucleofector™ System we recommend using the Primary Cell Optimization Kits and the respective optimization protocols. Optimal Nucleofection Conditions are transferable between these three systems. Human melanocyte specific kits are available for the Nucleofector™ II/2b Device.

### ■ Benefits

- Transfection efficiency: up to 70%
- Viability: up to 60%
- Reproducible non-viral transfection

### ■ Applications

- Kits suitable for neonatal human melanocytes (NHEM-neo)
- Optimal for both DNA and siRNA transfection



**Nucleofection of NHEM-Neo with eGFP cDNA.** NHEM-Neo were transfected by Nucleofection using a plasmid encoding enhanced green fluorescent protein, eGFP. 24 hours post Nucleofection, cells were analyzed by light (A) and fluorescence microscopy (B).

### Ordering Information – Kits

Cat. No. NA	Cat. No. EU	Product Name	Product Description	Size
<b>4D-Nucleofector™ Kits</b>				
V4XP-9096	V4XP-9096	Primary Cell Optimization 4D-Nucleofector™ X Kit	20 µL Nucleocuvette™ Strip	96 reactions (16-well)
<b>96-well Shuttle™ Kits</b>				
V4SP-9096	V4SP-9096	Primary Cell Optimization 96-well Nucleofector™ Kit	20 µL Nucleocuvette™ Plate	160 reactions (96-well)
<b>384-well Nucleofector™ Kits</b>				
V5SP-9001	V5SP-9001	Primary Cell Optimization 384-well Nucleofector™ Kit	20 µL Nucleocuvette™ Plate	384 reactions (384-well)
<b>Nucleofector™ II/2b Kits</b>				
VAPD-1003	VAPD-1003	Human Epidermal Melanocyte - Neonatal Nucleofector™ II/ 2b Kit	100 µL aluminum cuvette	10 reactions
VPD-1003	VPD-1003	Human Melanocyte - Neonatal Nucleofector™ II/ 2b Kit	100 µL aluminum cuvette	25 reactions
VVPD-1003	VVPD-1003	Human Epidermal Melanocyte - Neonatal Nucleofector™ II/ 2b Kit	100 µL aluminum cuvette	4 × 25 reactions

Related Products	Page
NHEM-Neo – Neonatal Normal Human Epidermal Melanocytes	61
MGM™ 4 Melanocyte Growth Medium-4 BulletKit™	62



## Nucleofector™ Kits for Human Coronary Artery Endothelial Cells (HCAEC)

Various Nucleofector™ Kits and corresponding Optimized Protocols are available for the transfection of HCAECs using the different Nucleofection Platforms.

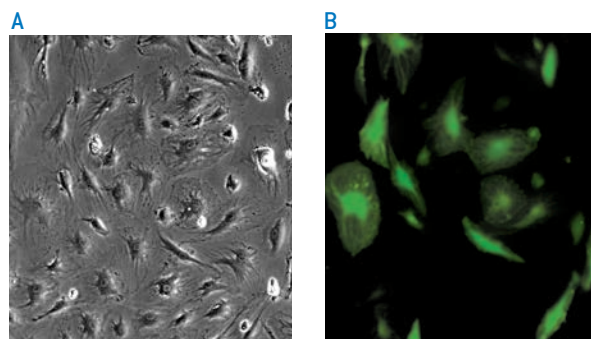
Optimal kits for transfection of HCAECs in the 4D-Nucleofector™, 96-well Shuttle™ or 384-well Nucleofector™ System are the P5 Primary Cell Kits used in combination with respective basic protocols for mammalian endothelial cells. HCAEC specific kits are available for the Nucleofector™ II/2b Device.

### ■ Benefits

- Transfection efficiency: up to 57%
- Viability: up to 42%

### ■ Applications

- Validated to work with Clonetics™ HCAEC
- Ideal for cardiovascular research e.g., on thrombosis, atherosclerosis or hypertension



Example for the Nucleofection of HCAEC. Clonetics™ HCAEC were transfected by Nucleofection with a plasmid encoding the fluorescent protein eGFP. 25 hours post Nucleofection, cells were analyzed by light (A) and fluorescence microscopy (B).

### Ordering Information – Kits

Cat. No. NA	Cat. No. EU	Product Name	Product Description	Size
<b>4D-Nucleofector™ Kits</b>				
V4XP-5012	V4XP-5012	P5 Primary Cell 4D-Nucleofector™ X Kit L	100 µL Nucleocuvette™ Vessel	12 reactions
V4XP-5024	V4XP-5024	P5 Primary Cell 4D-Nucleofector™ X Kit L	100 µL Nucleocuvette™ Vessel	24 reactions
V4XP-5032	V4XP-5032	P5 Primary Cell 4D-Nucleofector™ X Kit S	20 µL Nucleocuvette™ Strip	32 reactions (16-well)
<b>96-well Shuttle™ Kits</b>				
V4SP-5096	V4SP-5096	P5 Primary Cell 96-well Nucleofector™ Kit	20 µL Nucleocuvette™ Plate	96 reactions (96-well)
V4SP-5960	V4SP-5960	P5 Primary Cell 96-well Nucleofector™ Kit	20 µL Nucleocuvette™ Plate	960 reactions (96-well)
<b>384-well Nucleofector™ Kits</b>				
V5SP-5002	V5SP-5002	P5 Primary Cell 384-well Nucleofector™ Kit	20 µL Nucleocuvette™ Plate	768 reactions (384-well)
V5SP-5010	V5SP-5010	P5 Primary Cell 384-well Nucleofector™ Kit	20 µL Nucleocuvette™ Plate	3840 reactions (384-well)
<b>Nucleofector™ II/ 2b Kits</b>				
VPB-1001	VPB-1001	Human Coronary Artery Endothelial Cell Nucleofector™ II/ 2b Kit	100 µL aluminum cuvette	25 reactions
VVPB-1001	VVPB-1001	Human Coronary Artery Endothelial Cell Nucleofector™ II/ 2b Kit	100 µL aluminum cuvette	4 × 25 reactions

Related Products	Page
HCAEC – Human Coronary Artery Endothelial Cells	64
D-HCAEC – Diseased Human Coronary Aortic Endothelial Cells (Diabetes Type I or II)	64
EGM™ 2MV Microvascular Endothelial Cell Growth Medium-2 BulletKit™	83

## Nucleofector™ Kits for Human Microvascular Endothelial Cells – Lung (HMVEC-L)

Various Nucleofector™ Kits and corresponding Optimized Protocols are available for the transfection of HMVEC-L using the different Nucleofection Platforms.

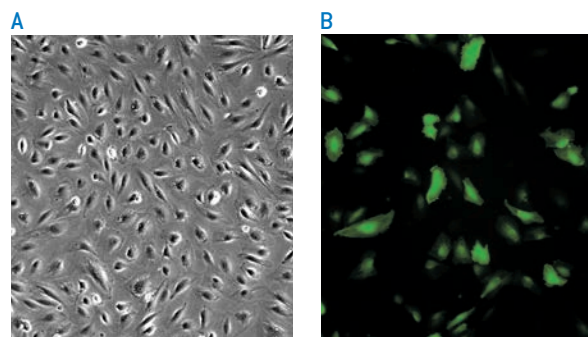
Optimal kits for transfection of HMVEC-L in the 4D-Nucleofector™, 96-well Shuttle™ or 384-well Nucleofector™ System are the P5 Primary Cell Kits used in combination with respective basic protocols for mammalian endothelial cells. HMVEC-L specific kits are available for the Nucleofector™ II/2b Device.

### ■ Benefits

- Transfection efficiency: up to 79%
- Viability: up to 52%
- Efficient transfection of HMVEC-L without the use of a viral system

### ■ Applications

- Validated to work with Clonetics™ HMVEC-L



**Example for the Nucleofection of Clonetics™ HMVEC-L.** HMVEC-L were transfected by Nucleofection using a plasmid encoding the enhanced green fluorescent protein eGFP. 25 hours post Nucleofection, cells were analyzed by light [A] and fluorescence microscopy [B].

### Ordering Information – Kits

Cat. No. NA	Cat. No. EU	Product Name	Product Description	Size
<b>4D-Nucleofector™ Kits</b>				
V4XP-5012	V4XP-5012	P5 Primary Cell 4D-Nucleofector™ X Kit L	100 µL Nucleocuvette™ Vessel	12 reactions
V4XP-5024	V4XP-5024	P5 Primary Cell 4D-Nucleofector™ X Kit L	100 µL Nucleocuvette™ Vessel	24 reactions
V4XP-5032	V4XP-5032	P5 Primary Cell 4D-Nucleofector™ X Kit S	20 µL Nucleocuvette™ Strip	32 reactions (16-well)
<b>96-well Shuttle™ Kits</b>				
V4SP-5096	V4SP-5096	P5 Primary Cell 96-well Nucleofector™ Kit	20 µL Nucleocuvette™ Plate	96 reactions (96-well)
V4SP-5960	V4SP-5960	P5 Primary Cell 96-well Nucleofector™ Kit	20 µL Nucleocuvette™ Plate	960 reactions (96-well)
<b>384-well Nucleofector™ Kits</b>				
V5SP-5002	V5SP-5002	P5 Primary Cell 384-well Nucleofector™ Kit	20 µL Nucleocuvette™ Plate	768 reactions (384-well)
V5SP-5010	V5SP-5010	P5 Primary Cell 384-well Nucleofector™ Kit	20 µL Nucleocuvette™ Plate	3840 reactions (384-well)
<b>Nucleofector™ II/ 2b Kits</b>				
VPB-1003	VPB-1003	Human Microvascular Endothelial Cell-Lung Nucleofector™ II/ 2b Kit	100 µL aluminum cuvette	25 reactions
VVPB-1003	VVPB-1003	Human Microvascular Endothelial Cell-Lung Nucleofector™ II/ 2b Kit	100 µL aluminum cuvette	4 × 25 reactions

Related Products	Page
HMVEC-L – Human Microvascular Endothelial Cells – Lung	66, 77
EGM™ 2MV Microvascular Endothelial Cell Growth Medium-2 BulletKit™	83

## Nucleofector™ Kits for Human Umbilical Vein Endothelial Cells (HUVEC)

Various Nucleofector™ Kits and corresponding Optimized Protocols are available for the transfection of HUVECs using the different Nucleofection Platforms.

Optimal kits for transfection of HUVECs in the 4D-Nucleofector™, 96-well Shuttle™ or 384-well Nucleofector™ System are the P5 Primary Cell Kits used in combination with cell-type specific protocols. HUVEC specific kits are available for the Nucleofector™ II/2b Device.

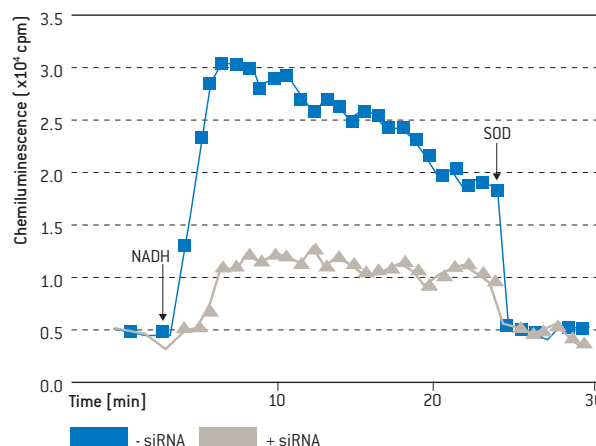
### ■ Benefits

- Transfection efficiency: up to 90%
- Viability: up to 74%
- High protein expression levels possible
- More than 60 publications on HUVEC Nucleofection

### ■ Applications

- Validated to work with Clonetics™ HUVEC
- Ideal for siRNA screening in drug discovery projects

**New** Nucleofection in adherent state is possible using the AD1 4D-Nucleofector™ Y Kit



**Nucleofection of HUVECs with siRNA.** Knockdown of the NAD(P)H oxidase Nox4 with siRNA shows that Nox4 is the major source for superoxide production in the nucleus of HUVECs. 48 hours after Nucleofection of HUVECs with Nox4 siRNA, the nuclear fraction was prepared and superoxide production was determined as superoxide dismutase (SOD)-inhibitable chemiluminescence detected with a luminol-based test. The reaction was started by the addition of NADH and stopped by addition of SOD. [Data from Kuroda et al. [2005] Genes Cells 10[12], 1139-1151.]

### Ordering Information – Kits

Cat. No. NA	Cat. No. EU	Product Name	Product Description	Size
<b>4D-Nucleofector™ Kits</b>				
V4XP-5012	V4XP-5012	P5 Primary Cell 4D-Nucleofector™ X Kit L	100 µL Nucleocuvette™ Vessel	12 reactions
V4XP-5024	V4XP-5024	P5 Primary Cell 4D-Nucleofector™ X Kit L	100 µL Nucleocuvette™ Vessel	24 reactions
V4XP-5032	V4XP-5032	P5 Primary Cell 4D-Nucleofector™ X Kit S	20 µL Nucleocuvette™ Strip	32 reactions [16-well]
V4YP-1A24	V4YP-1A24	AD1 4D-Nucleofector™ Y Kit	24-well Dipping Electrode	24 reactions
<b>96-well Shuttle™ Kits</b>				
V4SP-5096	V4SP-5096	P5 Primary Cell 96-well Nucleofector™ Kit	20 µL Nucleocuvette™ Plate	96 reactions [96-well]
V4SP-5960	V4SP-5960	P5 Primary Cell 96-well Nucleofector™ Kit	20 µL Nucleocuvette™ Plate	960 reactions [96-well]
<b>384-well Nucleofector™ Kits</b>				
V5SP-5002	V5SP-5002	P5 Primary Cell 384-well Nucleofector™ Kit	20 µL Nucleocuvette™ Plate	768 reactions [384-well]
V5SP-5010	V5SP-5010	P5 Primary Cell 384-well Nucleofector™ Kit	20 µL Nucleocuvette™ Plate	3840 reactions [384-well]
<b>Nucleofector™ II/ 2b Kits</b>				
VAPB-1002	VAPB-1002	Human Umbilical Vein Endothelial Cell Nucleofector™ II/ 2b Kit	100 µL aluminum cuvette	10 reactions
VPB-1002	VPB-1002	Human Umbilical Vein Endothelial Cell Nucleofector™ II/ 2b Kit	100 µL aluminum cuvette	25 reactions
WPB-1002	VVPB-1002	Human Umbilical Vein Endothelial Cell Nucleofector™ II/ 2b Kit	100 µL aluminum cuvette	4 × 25 reactions

Related Products	Page
HUVEC – Human Umbilical Vein Endothelial Cells	64
EGM™ 2 Endothelial Cell Growth Medium-2 BulletKit™	78

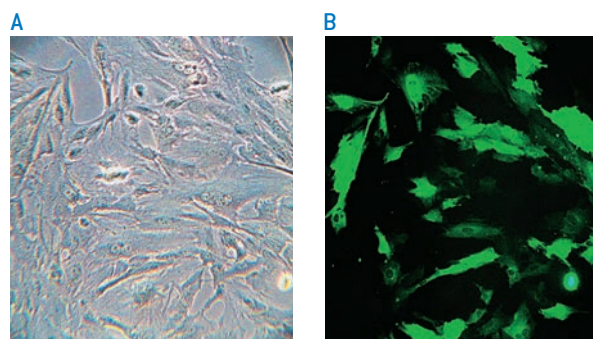
## Nucleofector™ Kits for Mammalian Endothelial Cells

For mammalian endothelial cells lacking a cell-type specific Optimized Protocol, we offer a selection of kits that can be used to easily define optimal Nucleofection Conditions. The P5 Primary Cell Kits together with the cell group-specific Basic Protocols are suited for optimizations of mammalian endothelial cells on the 4D-Nucleofector™ System, the 96-well Shuttle™ System or the 384-well Nucleofector™ System.

A cell-group specific Basic Kit is suited for optimization of mammalian endothelial cells using the Nucleofector™ II/2b Device.

### ■ Benefits


- Optimizations can be performed within one experiment
- Detailed protocols provide guidance through the optimization procedure
- Fine tuning of results is possible with the help of our Scientific Support Team
- Transfection efficiency: up to 90%
- Viability: up to 85%



**Example for Nucleofection of primary porcine endothelial cells.** Primary porcine trabecular meshwork cells (derived from eye) were transfected by Nucleofection with a plasmid encoding the green fluorescent maxGFP™ Reporter Protein. 24 hours post Nucleofection, the cells were analyzed by light [A] and fluorescence microscopy [B]. (Data courtesy of Dr. Ted Acott, Oregon Health & Science University, USA.)

### ■ Applications

- Kits suited for endothelial cells from different mammalian species and various organs
- Already tested for human pulmonary artery endothelial cells (Clonetics™ HPAEC), porcine capillary endothelial cells, sheep uterine artery endothelial cells, etc

 Nucleofection in adherent state is possible using the AD1 4D-Nucleofector™ Y Kit

### Ordering Information – Kits

Cat. No. NA	Cat. No. EU	Product Name	Product Description	Size
<b>4D-Nucleofector™ Kits</b>				
V4XP-5012	V4XP-5012	P5 Primary Cell 4D-Nucleofector™ X Kit L	100 µL Nucleocuvette™ Vessel	12 reactions
V4XP-5024	V4XP-5024	P5 Primary Cell 4D-Nucleofector™ X Kit L	100 µL Nucleocuvette™ Vessel	24 reactions
V4XP-5032	V4XP-5032	P5 Primary Cell 4D-Nucleofector™ X Kit S	20 µL Nucleocuvette™ Strip	32 reactions (16-well)
V4YP-1A24	V4YP-1A24	AD1 4D-Nucleofector™ Y Kit	24-well Dipping Electrode	24 reactions
<b>96-well Shuttle™ Kits</b>				
V4SP-5096	V4SP-5096	P5 Primary Cell 96-well Nucleofector™ Kit	20 µL Nucleocuvette™ Plate	96 reactions (96-well)
V4SP-5960	V4SP-5960	P5 Primary Cell 96-well Nucleofector™ Kit	20 µL Nucleocuvette™ Plate	960 reactions (96-well)
<b>384-well Nucleofector™ Kits</b>				
V5SP-5002	V5SP-5002	P5 Primary Cell 384-well Nucleofector™ Kit	20 µL Nucleocuvette™ Plate	768 reactions (384-well)
V5SP-5010	V5SP-5010	P5 Primary Cell 384-well Nucleofector™ Kit	20 µL Nucleocuvette™ Plate	3840 reactions (384-well)
<b>Nucleofector™ II/ 2b Kits</b>				
VAPI-1001	VAPI-1001	Basic Nucleofector™ II/ 2b Kit for Primary Mammalian Endothelial Cells	100 µL aluminum cuvette	10 reactions
VPI-1001	VPI-1001	Basic Nucleofector™ II/ 2b Kit for Primary Mammalian Endothelial Cells	100 µL aluminum cuvette	25 reactions
WPI-1001	WPI-1001	Basic Nucleofector™ II/ 2b Kit for Primary Mammalian Endothelial Cells	100 µL aluminum cuvette	4 × 25 reactions

### Related Products

Endothelial Cells and Media

Page

63–65

## Nucleofector™ Kits for Human Bronchial Epithelial Cells (NHBE)

Various Nucleofector™ Kits and corresponding Optimized Protocols are available for the transfection of NHBEs using the different Nucleofection Platforms.

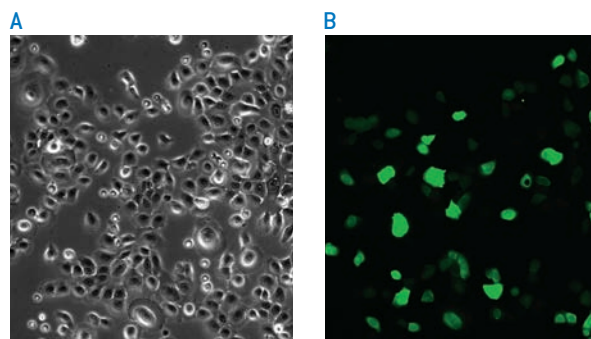
Optimal kits for transfection of NHBEs in the 4D-Nucleofector™, 96-well Shuttle™ or 384-well Nucleofector™ System are the P3 Primary Cell Kits used in combination with cell-type specific protocols. NHBE specific kits are available for the Nucleofector™ II/2b Device.

### ■ Benefits

- Transfection efficiency: up to 65%
- Viability: up to 53%

### ■ Applications

- Validated to work with Clonetics™ NHBE
- Also tested with asthmatic and COPD bronchial epithelial cells
- Easily verify previous cell line results in the analogous primary cell type



**Example of Nucleofection of NHBE.** Clonetics™ Normal Human Bronchial Epithelial Cells were transfected with pmaxGFP™ Vector. 24 hours post Nucleofection, cells were analyzed by light (A) or fluorescence (B) microscopy.

### Ordering Information – Kits

Cat. No. NA	Cat. No. EU	Product Name	Product Description	Size
<b>4D-Nucleofector™ Kits</b>				
V4XP-3012	V4XP-3012	P3 Primary Cell 4D-Nucleofector™ X Kit L	100 µL Nucleocuvette™ Vessel	12 reactions
V4XP-3024	V4XP-3024	P3 Primary Cell 4D-Nucleofector™ X Kit L	100 µL Nucleocuvette™ Vessel	24 reactions
V4XP-3032	V4XP-3032	P3 Primary Cell 4D-Nucleofector™ X Kit S	20 µL Nucleocuvette™ Strip	32 reactions (16-well)
<b>96-well Shuttle™ Kits</b>				
V4SP-3096	V4SP-3096	P3 Primary Cell 96-well Nucleofector™ Kit	20 µL Nucleocuvette™ Plate	96 reactions (96-well)
V4SP-3960	V4SP-3960	P3 Primary Cell 96-well Nucleofector™ Kit	20 µL Nucleocuvette™ Plate	960 reactions (96-well)
<b>384-well Nucleofector™ Kits</b>				
V5SP-3002	V5SP-3002	P3 Primary Cell 384-well Nucleofector™ Kit	20 µL Nucleocuvette™ Plate	768 reactions (384-well)
V5SP-3010	V5SP-3010	P3 Primary Cell 384-well Nucleofector™ Kit	20 µL Nucleocuvette™ Plate	3840 reactions (384-well)
<b>Nucleofector™ II/ 2b Kits</b>				
VAPI-1005	VAPI-1005	Basic Nucleofector™ II/ 2b Kit for Primary Mammalian Epithelial Cells	100 µL aluminum cuvette	10 reactions
VPI-1005	VPI-1005	Basic Nucleofector™ II/ 2b Kit for Primary Mammalian Epithelial Cells	100 µL aluminum cuvette	25 reactions
WVPI-1005	WVPI-1005	Basic Nucleofector™ II/ 2b Kit for Primary Mammalian Epithelial Cells	100 µL aluminum cuvette	4 × 25 reactions

Related Products	Page
NHBE – Bronchial /Tracheal Epithelial Cells	77
BEGM™ – Bronchial Epithelial Growth Medium BulletKit™	78
DHBE Diseased Bronchial/Tracheal Epithelial Cells (Asthma, COPD, or Cystic Fibrosis)	78–78

## Nucleofector™ Kits for Human Mammary Epithelial Cells (HMEC)

Various Nucleofector™ Kits and corresponding Optimized Protocols are available for the transfection of HMECs using the different Nucleofection Platforms.

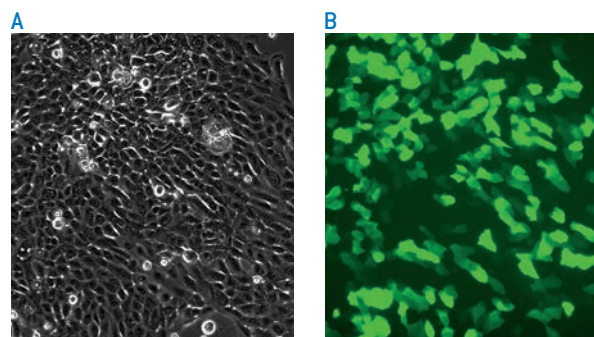
Optimal kits for transfection of HMECs in the 4D-Nucleofector™, 96-well Shuttle™ or 384-well Nucleofector™ System are the P3 Primary Cell Kits used in combination with cell-type specific protocols. HMEC specific kits are available for the Nucleofector™ II/2b Device.

### ■ Benefits

- Transfection efficiency: up to 73%
- Viability: up to 95%

### ■ Applications

- Validated to work with Clonetics™ HMEC
- Easily verify previous cell line results in the analogous primary cell type



**Example of Nucleofection of HMEC.** Clonetics™ Human Mammary Epithelial Cells were transfected with pmaxGFP™ Vector. 24 hours post Nucleofection, cells were analyzed by light (A) or fluorescence (B) microscopy.

### Ordering Information – Kits

Cat. No. NA	Cat. No. EU	Product Name	Product Description	Size
<b>4D-Nucleofector™ Kits</b>				
V4XP-3012	V4XP-3012	P3 Primary Cell 4D-Nucleofector™ X Kit L	100 µL Nucleocuvette™ Vessel	12 reactions
V4XP-3024	V4XP-3024	P3 Primary Cell 4D-Nucleofector™ X Kit L	100 µL Nucleocuvette™ Vessel	24 reactions
V4XP-3032	V4XP-3032	P3 Primary Cell 4D-Nucleofector™ X Kit S	20 µL Nucleocuvette™ Strip	32 reactions (16-well)
<b>96-well Shuttle™ Kits</b>				
V4SP-3096	V4SP-3096	P3 Primary Cell 96-well Nucleofector™ Kit	20 µL Nucleocuvette™ Plate	96 reactions (96-well)
V4SP-3960	V4SP-3960	P3 Primary Cell 96-well Nucleofector™ Kit	20 µL Nucleocuvette™ Plate	960 reactions (96-well)
<b>384-well Nucleofector™ Kits</b>				
V5SP-3002	V5SP-3002	P3 Primary Cell 384-well Nucleofector™ Kit	20 µL Nucleocuvette™ Plate	768 reactions (384-well)
V5SP-3010	V5SP-3010	P3 Primary Cell 384-well Nucleofector™ Kit	20 µL Nucleocuvette™ Plate	3840 reactions (384-well)
<b>Nucleofector™ II/ 2b Kits</b>				
VPK-1002	VPK-1002	Human Mammary Epithelial Cell Nucleofector™ II/ 2b Kit	100 µL aluminum cuvette	25 reactions
VVPK-1002	VVPK-1002	Human Mammary Epithelial Cell Nucleofector™ II/ 2b Kit	100 µL aluminum cuvette	4 × 25 reactions

Related Products	Page
HMEC – Human Mammary Epithelial Cells	70
MEGM™ – Mammary Epithelial Cell Growth Medium BulletKit™	70



## Nucleofector™ Kits for Mammalian Epithelial Cells

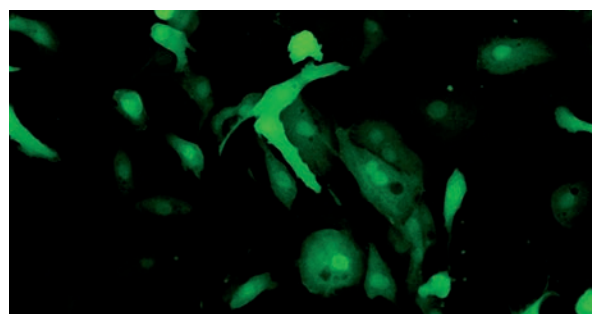
For mammalian epithelial cells lacking a cell-type specific Optimized Protocol, we offer a selection of kits that can be used to easily define optimal Nucleofection Conditions.

The P1 and P3 Primary Cell Kits together with the cell-group specific Basic Protocols are suited for optimizations of mammalian epithelial cells on the 4D-Nucleofector™ System, the 96-well Shuttle™ System or the 384-well Nucleofector™ System.

A cell group-specific Basic Kit is suited for optimization of mammalian epithelial cells using the Nucleofector™ II/2b Device.

### ■ Benefits

- Optimizations can be performed within one experiment
- Detailed protocols provide guidance through the optimization procedure
- Fine tuning of results is possible with help from our Scientific Support Team
- Transfection efficiency: up to 83%
- Viability: up to 98%



Example for Nucleofection of primary renal proximal tubular epithelial cells. Human renal proximal tubular epithelial cells were transfected by Nucleofection with a plasmid encoding the green fluorescent protein, eGFP. 48 hours post Nucleofection, cells were analyzed by fluorescence microscopy. [Data courtesy of C. Xu, R. L. Bacallao\*, and S. L. Alper. Department of Medicine, Beth Israel Deaconess Medical Center and Harvard Medical School, Boston, USA, \*University of Indiana School of Medicine, Indianapolis, USA.]

### ■ Applications

- Kits suited for epithelial cells from different mammalian species and various organs
- Already tested for renal proximal tubular epithelial cells (RPTEC), Clonetics™ Epithelial Cells: human prostate epithelial cells (hPrEC) and human small airway epithelial cells (SAEC)

### Ordering Information – Kits

Cat. No. NA	Cat. No. EU	Product Name	Product Description	Size
<b>4D-Nucleofector™ Kits</b>				
V4XP-1012	V4XP-1012	P1 Primary Cell 4D-Nucleofector™ X Kit L	100 µL Nucleocuvette™ Vessel	12 reactions
V4XP-1024	V4XP-1024	P1 Primary Cell 4D-Nucleofector™ X Kit L	100 µL Nucleocuvette™ Vessel	24 reactions
V4XP-1032	V4XP-1032	P1 Primary Cell 4D-Nucleofector™ X Kit S	20 µL Nucleocuvette™ Strip	32 reactions (16-well)
V4XP-3012	V4XP-3012	P3 Primary Cell 4D-Nucleofector™ X Kit L	100 µL Nucleocuvette™ Vessel	12 reactions
V4XP-3024	V4XP-3024	P3 Primary Cell 4D-Nucleofector™ X Kit L	100 µL Nucleocuvette™ Vessel	24 reactions
V4XP-3032	V4XP-3032	P3 Primary Cell 4D-Nucleofector™ X Kit S	20 µL Nucleocuvette™ Strip	32 reactions (16-well)
<b>96-well Shuttle™ Kits</b>				
V4SP-1096	V4SP-1096	P1 Primary Cell 96-well Nucleofector™ Kit	20 µL Nucleocuvette™ Plate	96 reactions (96-well)
V4SP-1960	V4SP-1960	P1 Primary Cell 96-well Nucleofector™ Kit	20 µL Nucleocuvette™ Plate	960 reactions (96-well)
V4SP-3096	V4SP-3096	P3 Primary Cell 96-well Nucleofector™ Kit	20 µL Nucleocuvette™ Plate	96 reactions (96-well)
V4SP-3960	V4SP-3960	P3 Primary Cell 96-well Nucleofector™ Kit	20 µL Nucleocuvette™ Plate	960 reactions (96-well)
<b>384-well Nucleofector™ Kits</b>				
V5SP-1002	V5SP-1002	P1 Primary Cell 384-well Nucleofector™ Kit	20 µL Nucleocuvette™ Plate	768 reactions (384-well)
V5SP-1010	V5SP-1010	P1 Primary Cell 384-well Nucleofector™ Kit	20 µL Nucleocuvette™ Plate	3840 reactions (384-well)
V5SP-3002	V5SP-3002	P3 Primary Cell 384-well Nucleofector™ Kit	20 µL Nucleocuvette™ Plate	768 reactions (384-well)
V5SP-3010	V5SP-3010	P3 Primary Cell 384-well Nucleofector™ Kit	20 µL Nucleocuvette™ Plate	3840 reactions (384-well)
<b>Nucleofector™ II/ 2b Kits</b>				
VAPI-1005	VAPI-1005	Basic Nucleofector™ II/ 2b Kit for Primary Mammalian Epithelial Cells	100 µL aluminum cuvette	10 reactions
VPI-1005	VPI-1005	Basic Nucleofector™ II/ 2b Kit for Primary Mammalian Epithelial Cells	100 µL aluminum cuvette	25 reactions
WVPI-1005	WVPI-1005	Basic Nucleofector™ II/ 2b Kit for Primary Mammalian Epithelial Cells	100 µL aluminum cuvette	4 × 25 reactions



## Nucleofector™ Kits for Human Dermal Fibroblasts (NHDF)

Various Nucleofector™ Kits and corresponding Optimized Protocols are available for the transfection of NHDF cells using the different Nucleofection Platforms.

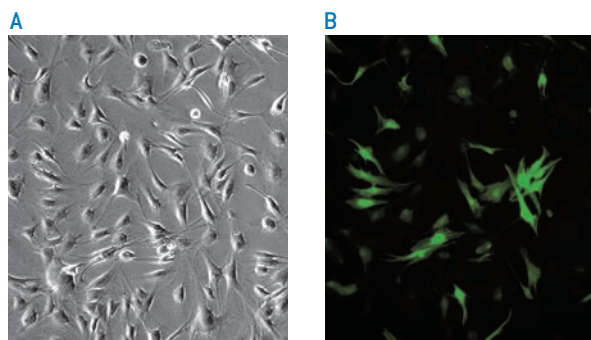
Optimal kits for transfection of NHDF cells in the 4D-Nucleofector™, 96-well Shuttle™ or 384-well Nucleofector™ System are the P2 Primary Cell Kits used in combination with cell-type specific protocols. NHDF cell specific kits are available for the Nucleofector™ II/2b Device.

### ■ Benefits

- Transfection efficiency: up to 90%
- Viability: up to 98%
- More than 90 publications citing Nucleofection of human dermal fibroblasts

### ■ Applications

- Validated to work with Clonetics™ NHDF, neonatal and adult
- Ideal for studying fibrosarcoma, fibrosis, scleroderma, or xeroderma pigmentosum
- Optimal for both DNA and siRNA transfection



**Nucleofection of adult human dermal fibroblasts with eGFP cDNA.** Clonetics™ NHDF-Adult were transfected by Nucleofection using a plasmid encoding eGFP. 24 hours post Nucleofection, cells were analyzed by light (A) and fluorescence microscopy (B).

 [www.lonza.com/citations](http://www.lonza.com/citations)

### Ordering Information – Kits

Cat. No. NA	Cat. No. EU	Product Name	Product Description	Size
<b>4D-Nucleofector™ Kits</b>				
V4XP-2012	V4XP-2012	P2 Primary Cell 4D-Nucleofector™ X Kit L	100 µL Nucleocuvette™ Vessel	12 reactions
V4XP-2024	V4XP-2024	P2 Primary Cell 4D-Nucleofector™ X Kit L	100 µL Nucleocuvette™ Vessel	24 reactions
V4XP-2032	V4XP-2032	P2 Primary Cell 4D-Nucleofector™ X Kit S	20 µL Nucleocuvette™ Strip	32 reactions (16-well)
<b>96-well Shuttle™ Kits</b>				
V4SP-2096	V4SP-2096	P2 Primary Cell 96-well Nucleofector™ Kit	20 µL Nucleocuvette™ Plate	96 reactions (96-well)
V4SP-2960	V4SP-2960	P2 Primary Cell 96-well Nucleofector™ Kit	20 µL Nucleocuvette™ Plate	960 reactions (96-well)
<b>384-well Nucleofector™ Kits</b>				
V5SP-2002	V5SP-2002	P2 Primary Cell 384-well Nucleofector™ Kit	20 µL Nucleocuvette™ Plate	768 reactions (384-well)
V5SP-2010	V5SP-2010	P2 Primary Cell 384-well Nucleofector™ Kit	20 µL Nucleocuvette™ Plate	3840 reactions (384-well)
<b>Nucleofector™ II/ 2b Kits</b>				
VAPD-1001	VAPD-1001	Human Dermal Fibroblast Nucleofector™ II/ 2b Kit	100 µL aluminum cuvette	10 reactions
VPD-1001	VPD-1001	Human Dermal Fibroblast Nucleofector™ II/ 2b Kit	100 µL aluminum cuvette	25 reactions
VVPD-1001	VVPD-1001	Human Dermal Fibroblast Nucleofector™ II/ 2b Kit	100 µL aluminum cuvette	4 × 25 reactions

Related Products	Page
NHDF-Ad – Human Adult Dermal Fibroblasts	61
NHDF-Neo – Neonatal Human Dermal Fibroblasts	61
FGM™ 2 – Fibroblast Growth Media BulletKit™	62

## Nucleofector™ Kits for Mouse Embryonic Fibroblasts (MEF)

Various Nucleofector™ Kits and corresponding Optimized Protocols are available for the transfection of MEFs using the different Nucleofection Platforms.

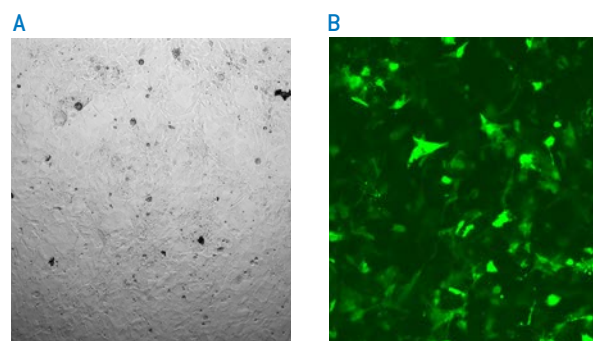
For the transfection of MEFs in the 4D-Nucleofector™, 96-well Shuttle™ or 384-well Nucleofector™ System we recommend using the Primary Cell Optimization Kits and the respective optimization protocols. Optimal Nucleofection Conditions are transferable between these three systems. MEF specific kits are available for the Nucleofector™ II/2b Device.

### ■ Benefits

- Transfection efficiency: up to 62%
- Viability: up to 88%

### ■ Applications

- Kits suitable for various mouse embryonic fibroblast clones



**Transfection efficiency of primary MEF cells 24 hours post Nucleofection.**  $1.0 \times 10^5$  cells were transfected with program CZ-167 using 0.4  $\mu\text{g}$  pmaxGFP™ Vector in 20  $\mu\text{L}$  Nucleocuvette™ Strips. Cells were analyzed 24 hours post Nucleofection by microscopy, (A) bright field, (B) fluorescence. Transfection efficiency as determined by flow cytometry was 67%.

### Ordering Information – Kits

Cat. No. NA	Cat. No. EU	Product Name	Product Description	Size
<b>4D-Nucleofector™ Kits</b>				
V4XP-4012	V4XP-4012	P4 Primary Cell 4D-Nucleofector™ X Kit L	100 $\mu\text{L}$ Nucleocuvette™ Vessel	12 reactions
V4XP-4024	V4XP-4024	P4 Primary Cell 4D-Nucleofector™ X Kit L	100 $\mu\text{L}$ Nucleocuvette™ Vessel	24 reactions
V4XP-4032	V4XP-4032	P4 Primary Cell 4D-Nucleofector™ X Kit S	20 $\mu\text{L}$ Nucleocuvette™ Strip	32 reactions (16-well)
<b>96-well Shuttle™ Kits</b>				
V4SP-4096	V4SP-4096	P4 Primary Cell 96-well Nucleofector™ Kit	20 $\mu\text{L}$ Nucleocuvette™ Plate	96 reactions (96-well)
V4SP-4960	V4SP-4960	P4 Primary Cell 96-well Nucleofector™ Kit	20 $\mu\text{L}$ Nucleocuvette™ Plate	960 reactions (96-well)
<b>384-well Nucleofector™ Kits</b>				
V5SP-4002	V5SP-4002	P4 Primary Cell 384-well Nucleofector™ Kit	20 $\mu\text{L}$ Nucleocuvette™ Plate	768 reactions (384-well)
V5SP-4010	V5SP-4010	P4 Primary Cell 384-well Nucleofector™ Kit	20 $\mu\text{L}$ Nucleocuvette™ Plate	3840 reactions (384-well)
<b>Nucleofector™ II/ 2b Kits</b>				
VPD-1006	VPD-1006	Mouse Embryonic Fibroblast Starter Nucleofector™ II/ 2b Kit	100 $\mu\text{L}$ aluminum cuvette	10 reactions
VAPD-1004	VAPD-1004	Mouse Embryonic Fibroblast Nucleofector™ II/ 2b Kit 1	100 $\mu\text{L}$ aluminum cuvette	10 reactions
VAPD-1005	VAPD-1005	Mouse Embryonic Fibroblast Nucleofector™ II/ 2b Kit 2	100 $\mu\text{L}$ aluminum cuvette	10 reactions
VPD-1004	VPD-1004	Mouse Embryonic Fibroblast Nucleofector™ II/ 2b Kit 1	100 $\mu\text{L}$ aluminum cuvette	25 reactions
VPD-1005	VPD-1005	Mouse Embryonic Fibroblast Nucleofector™ II/ 2b Kit 2	100 $\mu\text{L}$ aluminum cuvette	25 reactions
VVPD-1004	VVPD-1004	Mouse Embryonic Fibroblast Nucleofector™ II/ 2b Kit 1	100 $\mu\text{L}$ aluminum cuvette	4 × 25 reactions
VVPD-1005	VVPD-1005	Mouse Embryonic Fibroblast Nucleofector™ II/ 2b Kit 2	100 $\mu\text{L}$ aluminum cuvette	4 × 25 reactions

Related Products	Page
Mouse Embryonic Fibroblasts	93
Dulbecco's Modified Eagle's Medium	123-124

## Nucleofector™ Kits for Mammalian Fibroblasts

For mammalian fibroblasts lacking a cell-type specific Optimized Protocol, we offer a selection of kits that can be used to easily define optimal Nucleofection Conditions. The P2 and P3 Primary Cell Kits are suited for optimizations of mammalian fibroblasts on the 4D-Nucleofector™ System, the 96-well Shuttle™ System or the 384-well Nucleofector™ System.

A cell group-specific Basic Kit is suited for optimization of mammalian fibroblasts using the Nucleofector™ II/2b Device.

### ■ Benefits

- Optimizations can be performed within one experiment
- Detailed protocols to guide you through the optimization procedure
- Fine tuning of results is possible with the help of our Scientific Support Team
- Transfection efficiency: up to 90%
- Viability: up to 98%

### ■ Applications

- Kits suited for fibroblasts from different mammalian species and various organs
- Already tested for macaque dermal fibroblasts, bovine fibroblasts, human colon myofibroblasts, mouse lung fibroblasts, etc.

### Ordering Information – Kits

Cat. No. NA	Cat. No. EU	Product Name	Product Description	Size
<b>4D-Nucleofector™ Kits</b>				
V4XP-2012	V4XP-2012	P2 Primary Cell 4D-Nucleofector™ X Kit L	100 µL Nucleocuvette™ Vessel	12 reactions
V4XP-2024	V4XP-2024	P2 Primary Cell 4D-Nucleofector™ X Kit L	100 µL Nucleocuvette™ Vessel	24 reactions
V4XP-2032	V4XP-2032	P2 Primary Cell 4D-Nucleofector™ X Kit S	20 µL Nucleocuvette™ Strip	32 reactions (16-well)
V4XP-3012	V4XP-3012	P3 Primary Cell 4D-Nucleofector™ X Kit L	100 µL Nucleocuvette™ Vessel	12 reactions
V4XP-3024	V4XP-3024	P3 Primary Cell 4D-Nucleofector™ X Kit L	100 µL Nucleocuvette™ Vessel	24 reactions
V4XP-3032	V4XP-3032	P3 Primary Cell 4D-Nucleofector™ X Kit S	20 µL Nucleocuvette™ Strip	32 reactions (16-well)
<b>96-well Shuttle™ Kits</b>				
V4SP-2096	V4SP-2096	P2 Primary Cell 96-well Nucleofector™ Kit	20 µL Nucleocuvette™ Plate	96 reactions (96-well)
V4SP-2960	V4SP-2960	P2 Primary Cell 96-well Nucleofector™ Kit	20 µL Nucleocuvette™ Plate	960 reactions (96-well)
V4SP-3096	V4SP-3096	P3 Primary Cell 96-well Nucleofector™ Kit	20 µL Nucleocuvette™ Plate	96 reactions (96-well)
V4SP-3960	V4SP-3960	P3 Primary Cell 96-well Nucleofector™ Kit	20 µL Nucleocuvette™ Plate	960 reactions (96-well)
<b>384-well Nucleofector™ Kits</b>				
V5SP-2002	V5SP-2002	P2 Primary Cell 384-well Nucleofector™ Kit	20 µL Nucleocuvette™ Plate	768 reactions (384-well)
V5SP-2010	V5SP-2010	P2 Primary Cell 384-well Nucleofector™ Kit	20 µL Nucleocuvette™ Plate	3840 reactions (384-well)
V5SP-3002	V5SP-3002	P3 Primary Cell 384-well Nucleofector™ Kit	20 µL Nucleocuvette™ Plate	768 reactions (384-well)
V5SP-3010	V5SP-3010	P3 Primary Cell 384-well Nucleofector™ Kit	20 µL Nucleocuvette™ Plate	3840 reactions (384-well)
<b>Nucleofector™ II/ 2b Kits</b>				
VAPI-1002	VAPI-1002	Basic Nucleofector™ II/ 2b Kit for Primary Mammalian Fibroblasts	100 µL aluminum cuvette	10 reactions
VPI-1002	VPI-1002	Basic Nucleofector™ II/ 2b Kit for Primary Mammalian Fibroblasts	100 µL aluminum cuvette	25 reactions
WPPI-1002	WPPI-1002	Basic Nucleofector™ II/ 2b Kit for Primary Mammalian Fibroblasts	100 µL aluminum cuvette	4 × 25 reactions

## Nucleofector™ Kits for Human Hepatocytes

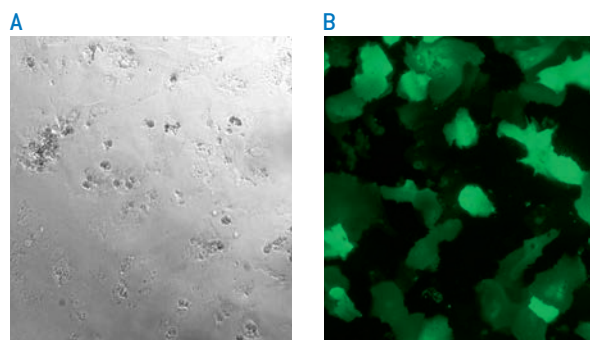
Various Nucleofector™ Kits and corresponding Optimized Protocols are available for the transfection of human hepatocytes using the different Nucleofection Platforms. Optimal kits for transfection of human hepatocytes in the 4D-Nucleofector™, 96-well Shuttle™ or 384-well Nucleofector™ System are the P3 Primary Cell Kits used in combination with cell-type specific protocols.

### ■ Benefits

- Transfection efficiency: up to 54%
- Viability: up to 69%
- Cells retain their functionality for up to 120 hours
- Efficient non-viral transfection of non or low proliferating cells

### ■ Applications

- Excellent transfection rates for DNA and siRNA
- Study metabolic pathways and toxic effects of new therapeutic agents



Example showing typical Nucleofection results of human hepatocytes. Cryopreserved human hepatocytes were transfected with pmaxGFP™ Vector. 120 hours post Nucleofection, cells were analyzed by light (A) and fluorescence microscopy (B).

### Ordering Information – Kits

Cat. No. NA	Cat. No. EU	Product Name	Product Description	Size
<b>4D-Nucleofector™ Kits</b>				
V4XP-3012	V4XP-3012	P3 Primary Cell 4D-Nucleofector™ X Kit L	100 µL Nucleocuvette™ Vessel	12 reactions
V4XP-3024	V4XP-3024	P3 Primary Cell 4D-Nucleofector™ X Kit L	100 µL Nucleocuvette™ Vessel	24 reactions
V4XP-3032	V4XP-3032	P3 Primary Cell 4D-Nucleofector™ X Kit S	20 µL Nucleocuvette™ Strip	32 reactions (16-well)
<b>96-well Shuttle™ Kits</b>				
V4SP-3096	V4SP-3096	P3 Primary Cell 96-well Nucleofector™ Kit	20 µL Nucleocuvette™ Plate	96 reactions (96-well)
V4SP-3960	V4SP-3960	P3 Primary Cell 96-well Nucleofector™ Kit	20 µL Nucleocuvette™ Plate	960 reactions (96-well)
<b>384-well Nucleofector™ Kits</b>				
V5SP-3002	V5SP-3002	P3 Primary Cell 384-well Nucleofector™ Kit	20 µL Nucleocuvette™ Plate	768 reactions (384-well)
V5SP-3010	V5SP-3010	P3 Primary Cell 384-well Nucleofector™ Kit	20 µL Nucleocuvette™ Plate	3840 reactions (384-well)

## Nucleofector™ Kits for Mouse or Rat Hepatocytes

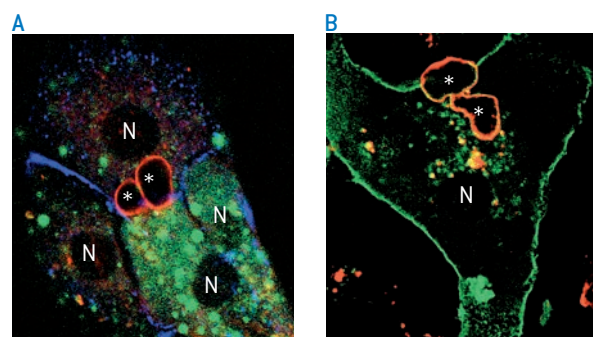
Various Nucleofector™ Kits and corresponding Optimized Protocols are available for the transfection of mouse or rat hepatocytes using the different Nucleofection Platforms. For the transfection of mouse or rat hepatocytes in the 4D-Nucleofector™, 96-well Shuttle™ or 384-well Nucleofector™ System we recommend using the Primary Cell Optimization Kits and the respective optimization protocols. Optimal Nucleofection Conditions are transferable between these three systems. Mouse and rat hepatocyte specific kits are available for the Nucleofector™ II/2b Device.

### ■ Benefits

- Transfection efficiency: up to 54%
- Viability: up to 80%
- Cells retain functional properties

### ■ Applications

- Kits suitable for mouse or rat hepatocytes
- Suited for DNA and siRNA transfections
- Ideal for research on new therapeutic agents and toxicity mechanisms



N = nuclei; \* = bile canaliculi

**Hepatocytes transfected by Nucleofection maintain their morphology and polarization.** Primary rat hepatocytes were transfected by Nucleofection with the pmxGFP™ Vector [A] or a plasmid containing the cDNA sequence for a plasma membrane receptor-YFP fusion protein [B]. Cells were stained with antibodies against desmoplakin [A; blue] to visualize cell boundaries and against multidrug resistance protein 2 [MRP2; A+B; red] to show the apical, canalicular membrane. maxGFP™ Reporter Protein was located in the cytosol of transfected cells [A]. YFP-fusion protein was correctly targeted to both the basolateral and the apical membrane domain as shown by co-localization with MRP2 [B]. These data prove normal formation of bile canaliculi in hepatocytes transfected by Nucleofection. [Data courtesy of V. Keitel, F. Schliess and D. Häussinger, Department for Gastroenterology, Hepatology and Infectiology, Heinrich-Heine-University Düsseldorf, Germany.]

### Ordering Information – Kits

Cat. No. NA	Cat. No. EU	Product Name	Product Description	Size
<b>4D-Nucleofector™ Kits</b>				
V4XP-9096	V4XP-9096	Primary Cell Optimization 4D-Nucleofector™ X Kit	20 µL Nucleocuvette™ Strip	96 reactions (16-well)
<b>96-well Shuttle™ Kits</b>				
V4SP-9096	V4SP-9096	Primary Cell Optimization 96-well Nucleofector™ Kit	20 µL Nucleocuvette™ Plate	160 reactions (96-well)
<b>384-well Nucleofector™ Kits</b>				
V5SP-9001	V5SP-9001	Primary Cell Optimization 384-well Nucleofector™ Kit	20 µL Nucleocuvette™ Plate	384 reactions (384-well)
<b>Nucleofector™ II/ 2b Kits</b>				
VAPL-1004	VAPL-1004	Mouse/Rat Hepatocyte Nucleofector™ II/ 2b Kit	100 µL aluminum cuvette	10 reactions
VPL-1004	VPL-1004	Mouse/Rat Hepatocyte Nucleofector™ II/ 2b Kit	100 µL aluminum cuvette	25 reactions
WPPL-1004	WPPL-1004	Mouse/Rat Hepatocyte Nucleofector™ II/ 2b Kit	100 µL aluminum cuvette	4 × 25 reactions

## Nucleofector™ Kits for Human Aortic Smooth Muscle Cells (AoSMC)

Various Nucleofector™ Kits and corresponding Optimized Protocols are available for the transfection of human AoSMCs using the different Nucleofection Platforms.

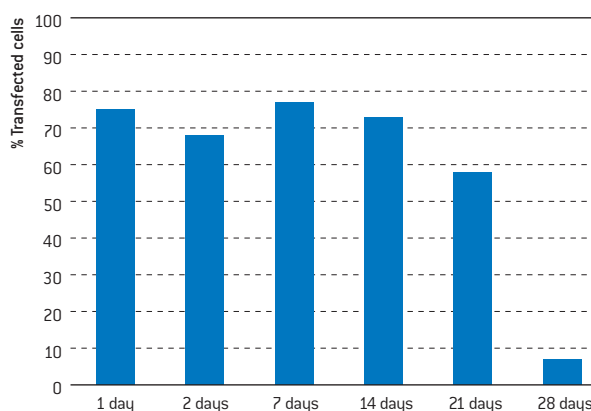
Optimal kits for transfection of human AoSMCs in the 4D-Nucleofector™, 96-well Shuttle™ or 384-well Nucleofector™ System are the P1 Primary Cell Kits used in combination with respective basic protocols for mammalian smooth muscle cells. Human AoSMC specific kits are available for the Nucleofector™ II/2b Device.

### ■ Benefits

- Transfection efficiency: up to 80%
- Viability: up to 96%
- 10-fold higher transfection efficiency compared to lipofection

### ■ Applications

- Kit suitable for human aortic and vascular smooth muscle cells
- Applicable for transient long-term expression up to three weeks
- Ideal tool for studies on human vascular disorders, such as atherosclerosis and stroke



**Time course of transient expression of transfected human AoSMC.** Clonetics™ Human AoSMC were transfected by Nucleofection using a plasmid encoding the mouse MHC class I heavy chain molecule H-2Kk. 1, 2, 7, 14, 21, and 28 days post Nucleofection, the cells were analyzed for their H-2Kk expression by flow cytometry. Dead cells were excluded from the analysis by propidium iodide staining and gating.

### Ordering Information – Kits

Cat. No. NA	Cat. No. EU	Product Name	Product Description	Size
<b>4D-Nucleofector™ Kits</b>				
V4XP-1012	V4XP-1012	P1 Primary Cell 4D-Nucleofector™ X Kit L	100 µL Nucleocuvette™ Vessel	12 reactions
V4XP-1024	V4XP-1024	P1 Primary Cell 4D-Nucleofector™ X Kit L	100 µL Nucleocuvette™ Vessel	24 reactions
V4XP-1032	V4XP-1032	P1 Primary Cell 4D-Nucleofector™ X Kit S	20 µL Nucleocuvette™ Strip	32 reactions (16-well)
<b>96-well Shuttle™ Kits</b>				
V4SP-1096	V4SP-1096	P1 Primary Cell 96-well Nucleofector™ Kit	20 µL Nucleocuvette™ Plate	96 reactions (96-well)
V4SP-1960	V4SP-1960	P1 Primary Cell 96-well Nucleofector™ Kit	20 µL Nucleocuvette™ Plate	960 reactions (96-well)
<b>384-well Nucleofector™ Kits</b>				
V5SP-1002	V5SP-1002	P1 Primary Cell 384-well Nucleofector™ Kit	20 µL Nucleocuvette™ Plate	768 reactions (384-well)
V5SP-1010	V5SP-1010	P1 Primary Cell 384-well Nucleofector™ Kit	20 µL Nucleocuvette™ Plate	3840 reactions (384-well)
<b>Nucleofector™ II/ 2b Kits</b>				
VAPC-1001	VAPC-1001	Human Aortic Smooth Muscle Cell Nucleofector™ II/ 2b Kit	100 µL aluminum cuvette	10 reactions
VPC-1001	VPC-1001	Human Aortic Smooth Muscle Cell Nucleofector™ II/ 2b Kit	100 µL aluminum cuvette	25 reactions
WVPC-1001	WVPC-1001	Human Aortic Smooth Muscle Cell Nucleofector™ II/ 2b Kit	100 µL aluminum cuvette	4 × 25 reactions

Related Products	Page
AoSMC – Human Aortic Smooth Muscle Cells	58
SmGM™ 2 Smooth Muscle Cell Growth Media BulletKit™	79
D-AoSMC – Diseased Human Aortic Smooth Muscle Cells (Diabetes Type I or II)	58-64



## Nucleofector™ Kits for Human Skeletal Muscle Myoblasts

Optimal kits for transfection of human skeletal muscle cells (HSMM) in the 4D-Nucleofector™ X Unit are the P5 Primary Cell Kits, used in combination with the cell-type specific protocol. Due to transferability between all platforms, same conditions apply for the 96-well Shuttle™ or 384-well Nucleofector™ Systems.

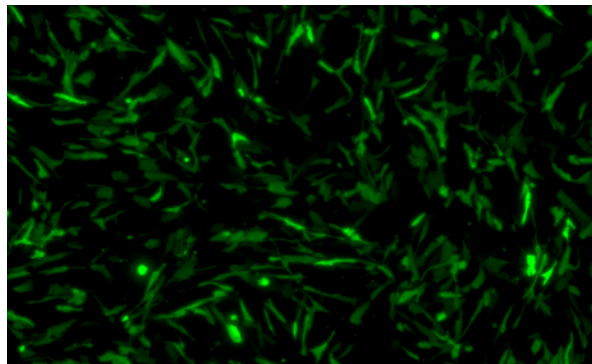
### ■ Benefits

- Transfection efficiency: up to 78%
- Viability: up to 62%

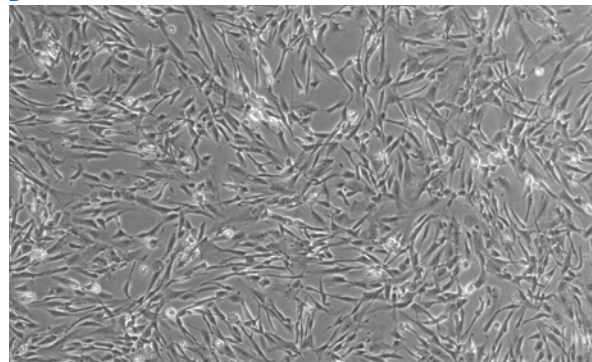
### ■ Applications

- Validated to work with Clonetics™ HSMM
- Easily verify previous cell line results in the analogous primary cell type

A



B



**Example of Nucleofection of HSMM.** Clonetics™ Human Skeletal Muscle Myoblasts were transfected with pmaxGFP™ Vector. 24 hours post Nucleofection, cells were analyzed by light (A) or fluorescence (B) microscopy.

### Ordering Information – Kits

Cat. No. NA	Cat. No. EU	Product Name	Product Description	Size
<b>4D-Nucleofector™ Kits</b>				
V4XP-5012	V4XP-5012	P5 Primary Cell 4D-Nucleofector™ X Kit L	100 µL Nucleocuvette™ Vessel	12 reactions
V4XP-5024	V4XP-5024	P5 Primary Cell 4D-Nucleofector™ X Kit L	100 µL Nucleocuvette™ Vessel	24 reactions
V4XP-5032	V4XP-5032	P5 Primary Cell 4D-Nucleofector™ X Kit S	20 µL Nucleocuvette™ Strip	32 reactions (16-well)
<b>96-well Shuttle™ Kits</b>				
V4SP-5096	V4SP-5096	P5 Primary Cell 96-well Nucleofector™ Kit	20 µL Nucleocuvette™ Plate	96 reactions (96-well)
V4SP-5960	V4SP-5960	P5 Primary Cell 96-well Nucleofector™ Kit	20 µL Nucleocuvette™ Plate	960 reactions (96-well)
<b>384-well Nucleofector™ Kits</b>				
V5SP-5002	V5SP-5002	P5 Primary Cell 384-well Nucleofector™ Kit	20 µL Nucleocuvette™ Plate	768 reactions (384-well)
V5SP-5010	V5SP-5010	P5 Primary Cell 384-well Nucleofector™ Kit	20 µL Nucleocuvette™ Plate	3840 reactions (384-well)

Related Products	Page
HSMM – Human Skeletal Muscle Myoblasts	87
D-HSMM – Diseased Human Skeletal Muscle Myoblasts (Diabetes Type I or II)	87
SkGM™ – Skeletal Muscle Cell Growth Media BulletKit™	87



## Nucleofector™ Kits for Mammalian Smooth Muscle Cells

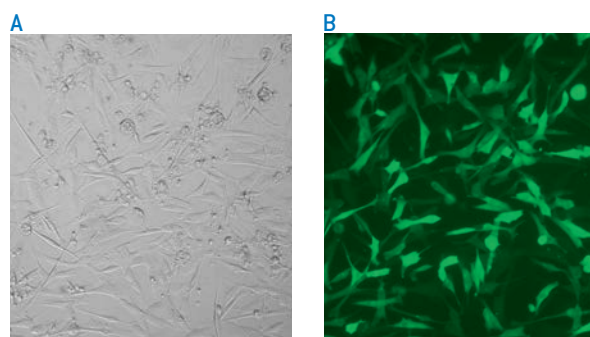
For mammalian smooth muscle cells lacking a cell-type specific Optimized Protocol, we offer a selection of kits that can be used to easily define optimal Nucleofection Conditions.

The P1 Primary Cell Kits together with the cell-group specific Basic Protocols are suited for optimizations of mammalian smooth muscle cells on the 4D-Nucleofector™ System, the 96-well Shuttle™ System or the 384-well Nucleofector™ System.

A cell-group specific Basic Kit is suited for optimization of mammalian smooth muscle cells using the Nucleofector™ II/2b Device.

### ■ Benefits

- Optimizations can be performed within one experiment
- Detailed protocols guiding through the optimization procedure
- Fine tuning of results is possible with the help of our Scientific Support Team
- Transfection efficiency: up to 95%
- Viability: up to 96%



**Nucleofection™ of primary smooth muscle cells.** Primary pulmonary artery smooth muscle cells were transfected with pmaxGFP™ Vector. 24 hours post Nucleofection, cells were analyzed by light (A) and fluorescence (B) microscopy.

### ■ Applications

- Kits suited for smooth muscle cells from different mammalian species and various organs
- Already tested for porcine vascular smooth muscle cells and coronary artery smooth muscle cells (Clonetics™ CASMC)

### Ordering Information – Kits

Cat. No. NA	Cat. No. EU	Product Name	Product Description	Size
<b>4D-Nucleofector™ Kits</b>				
V4XP-1012	V4XP-1012	P1 Primary Cell 4D-Nucleofector™ X Kit L	100 µL Nucleocuvette™ Vessel	12 reactions
V4XP-1024	V4XP-1024	P1 Primary Cell 4D-Nucleofector™ X Kit L	100 µL Nucleocuvette™ Vessel	24 reactions
V4XP-1032	V4XP-1032	P1 Primary Cell 4D-Nucleofector™ X Kit S	20 µL Nucleocuvette™ Strip	32 reactions (16-well)
<b>96-well Shuttle™ Kits</b>				
V4SP-1096	V4SP-1096	P1 Primary Cell 96-well Nucleofector™ Kit	20 µL Nucleocuvette™ Plate	96 reactions (96-well)
V4SP-1960	V4SP-1960	P1 Primary Cell 96-well Nucleofector™ Kit	20 µL Nucleocuvette™ Plate	960 reactions (96-well)
<b>384-well Nucleofector™ Kits</b>				
V5SP-1002	V5SP-1002	P1 Primary Cell 384-well Nucleofector™ Kit	20 µL Nucleocuvette™ Plate	768 reactions (384-well)
V5SP-1010	V5SP-1010	P1 Primary Cell 384-well Nucleofector™ Kit	20 µL Nucleocuvette™ Plate	3840 reactions (384-well)
<b>Nucleofector™ II/ 2b Kits</b>				
VAPI-1004	VAPI-1004	Basic Nucleofector™ II/ 2b Kit for Primary Mammalian Smooth Muscle Cells	100 µL aluminum cuvette	10 reactions
VPI-1004	VPI-1004	Basic Nucleofector™ II/ 2b Kit for Primary Mammalian Smooth Muscle Cells	100 µL aluminum cuvette	25 reactions
VWPI-1004	VWPI-1004	Basic Nucleofector™ II/ 2b Kit for Primary Mammalian Smooth Muscle Cells	100 µL aluminum cuvette	4 × 25 reactions

Related Products	Page
Human Smooth Muscle Cells	58
SmGM™ 2 Smooth Muscle Cell Growth Media BulletKit™	79

## Nucleofector™ Kits for Chicken Neurons


Various Nucleofector™ Kits and corresponding Optimized Protocols are available for the transfection of chicken neurons using the different Nucleofection Platforms. Optimal kits for transfection of chicken neurons in the 4D-Nucleofector™, 96-well Shuttle™ or 384-well Nucleofector™ System are the P3 Primary Cell Kits used in combination with respective basic protocols for mammalian neurons. Chicken neuron specific kits are available for the Nucleofector™ II/2b Device.

### Benefits

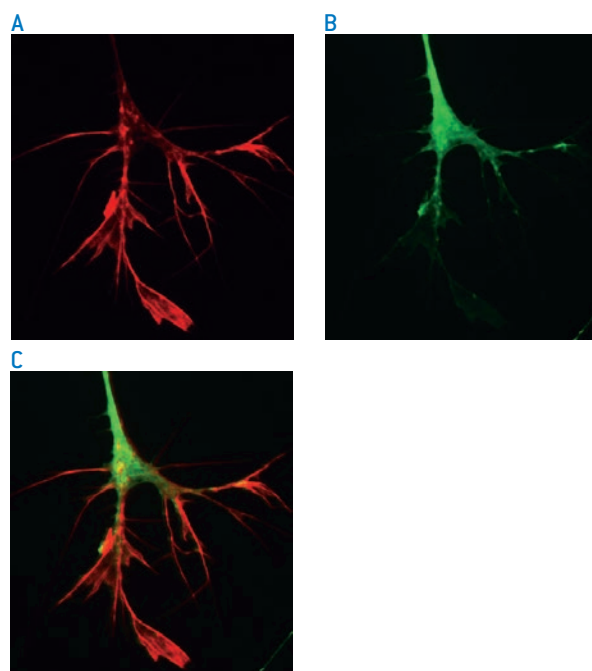
- Transfection efficiency: up to 43%
- Transgene expression for more than one week
- Cells retain morphological and functional properties

### Applications

- Kits suitable for hippocampal neurons and dorsal root ganglia neurons

 Nucleofection in adherent state is possible using the AD1 4D-Nucleofector™ Y Kit

 [www.lonza.com/celldatabase](http://www.lonza.com/celldatabase)



Formation of normal growth cones indicates maintenance of functionality of dorsal root ganglia after Nucleofection. DRG neurons from chicken were transfected by Nucleofection with a plasmid encoding the GFP protein. After cultivation on pre-coated glass coverslips overnight, single cells were analyzed for formation of normal growth cones [A – C], F-actin localization after staining with Alexa 568 conjugated phalloidin [A and C] and GFP expression [B and C]. (Photograph courtesy of B. Eickholt, King's College, London, Great Britain.)

### Ordering Information – Kits

Cat. No. NA	Cat. No. EU	Product Name	Product Description	Size
<b>4D-Nucleofector™ Kits</b>				
V4XP-3012	V4XP-3012	P3 Primary Cell 4D-Nucleofector™ X Kit L	100 µL Nucleocuvette™ Vessel	12 reactions
V4XP-3024	V4XP-3024	P3 Primary Cell 4D-Nucleofector™ X Kit L	100 µL Nucleocuvette™ Vessel	24 reactions
V4XP-3032	V4XP-3032	P3 Primary Cell 4D-Nucleofector™ X Kit S	20 µL Nucleocuvette™ Strip	32 reactions (16-well)
V4YP-1A24	V4YP-1A24	AD1 4D-Nucleofector™ Y Kit	24-well Dipping Electrode	24 reactions
<b>96-well Shuttle™ Kits</b>				
V4SP-3096	V4SP-3096	P3 Primary Cell 96-well Nucleofector™ Kit	20 µL Nucleocuvette™ Plate	96 reactions (96-well)
V4SP-3960	V4SP-3960	P3 Primary Cell 96-well Nucleofector™ Kit	20 µL Nucleocuvette™ Plate	960 reactions (96-well)
<b>384-well Nucleofector™ Kits</b>				
V5SP-3002	V5SP-3002	P3 Primary Cell 384-well Nucleofector™ Kit	20 µL Nucleocuvette™ Plate	768 reactions (384-well)
V5SP-3010	V5SP-3010	P3 Primary Cell 384-well Nucleofector™ Kit	20 µL Nucleocuvette™ Plate	3840 reactions (384-well)
<b>Nucleofector™ II/ 2b Kits</b>				
VPG-1002	VPG-1002	Chicken Neuron Nucleofector™ II/ 2b Kit	100 µL aluminum cuvette	25 reactions
WPG-1002	WPG-1002	Chicken Neuron Nucleofector™ II/ 2b Kit	100 µL aluminum cuvette	4 × 25 reactions

### Related Products

PNGM™ Primary Neuron Growth Media BulletKit™

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## Nucleofector™ Kits for Mouse Neurons

Various Nucleofector™ Kits and corresponding Optimized Protocols are available for the transfection of mouse neurons using the different Nucleofection Platforms.

Optimal kits for transfection of mouse neurons in the 4D-Nucleofector™, 96-well Shuttle™ or 384-well Nucleofector™ System are the P3 Primary Cell Kits used in combination with respective basic protocols for mammalian neurons. Mouse neuron specific kits are available for the Nucleofector™ II/2b Device.

### ■ Benefits

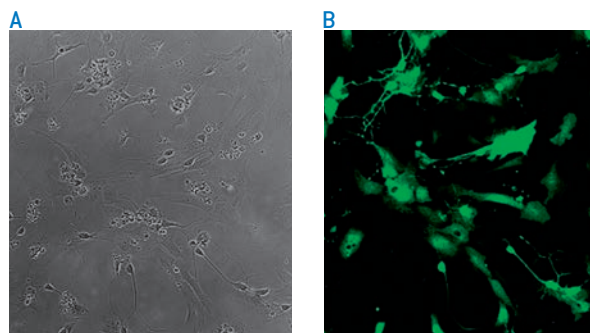
- Transfection efficiency: up to 60%
- Viability: up to 65 %
- Transgene expression for more than one week
- Cells retain morphological and functional properties

### ■ Applications


- Kits suitable for hippocampal, cortical and dorsal root ganglia neurons

**New** Nucleofection in adherent state is possible using the AD1 4D-Nucleofector™ Y Kit

- More than 50 peer-reviewed publications



**Nucleofection of primary mouse hippocampal neurons.** Primary dissociated neurons of mixed glial cultures were transfected using a plasmid encoding the enhanced green fluorescent protein eGFP. 48 hours post Nucleofection, the cells were analyzed by light [A] and fluorescence microscopy [B]. [Photograph courtesy of A. Dityatev, G. Dityateva and M. Hammond, Center for Molecular Neurobiology, Hamburg, Germany.]

 [www.lonza.com/celldatabase](http://www.lonza.com/celldatabase)  
[www.lonza.com/citations](http://www.lonza.com/citations)

### Ordering Information – Kits

Cat. No. NA	Cat. No. EU	Product Name	Product Description	Size
<b>4D-Nucleofector™ Kits</b>				
V4XP-3012	V4XP-3012	P3 Primary Cell 4D-Nucleofector™ X Kit L	100 µL Nucleocuvette™ Vessel	12 reactions
V4XP-3024	V4XP-3024	P3 Primary Cell 4D-Nucleofector™ X Kit L	100 µL Nucleocuvette™ Vessel	24 reactions
V4XP-3032	V4XP-3032	P3 Primary Cell 4D-Nucleofector™ X Kit S	20 µL Nucleocuvette™ Strip	32 reactions (16-well)
V4YP-1A24	V4YP-1A24	AD1 4D-Nucleofector™ Y Kit	24-well Dipping Electrode	24 reactions
<b>96-well Shuttle™ Kits</b>				
V4SP-3096	V4SP-3096	P3 Primary Cell 96-well Nucleofector™ Kit	20 µL Nucleocuvette™ Plate	96 reactions (96-well)
V4SP-3960	V4SP-3960	P3 Primary Cell 96-well Nucleofector™ Kit	20 µL Nucleocuvette™ Plate	960 reactions (96-well)
<b>384-well Nucleofector™ Kits</b>				
V5SP-3002	V5SP-3002	P3 Primary Cell 384-well Nucleofector™ Kit	20 µL Nucleocuvette™ Plate	768 reactions (384-well)
V5SP-3010	V5SP-3010	P3 Primary Cell 384-well Nucleofector™ Kit	20 µL Nucleocuvette™ Plate	3840 reactions (384-well)
<b>Nucleofector™ II/ 2b Kits</b>				
VAPG-1001	VAPG-1001	Mouse Neuron Nucleofector™ II/ 2b Kit	100 µL aluminum cuvette	10 reactions
VPG-1001	VPG-1001	Mouse Neuron Nucleofector™ II/ 2b Kit	100 µL aluminum cuvette	25 reactions
VVPG-1001	VVPG-1001	Mouse Neuron Nucleofector™ II/ 2b Kit	100 µL aluminum cuvette	4 × 25 reactions
<b>Related Products</b>				<b>Page</b>
Primary Mouse Neural Cells				96
PNGM™ Primary Neuron Growth Media BulletKit™				96-97

## Nucleofector™ Kits for Rat Neurons

Various Nucleofector™ Kits and corresponding Optimized Protocols are available for the transfection of rat neurons using the different Nucleofection Platforms.


Optimal kits for transfection of rat neurons in the 4D-Nucleofector™, 96-well Shuttle™ or 384-well Nucleofector™ System are the P3 Primary Cell Kits used in combination with cell-type specific protocols. Rat neuron specific kits are available for the Nucleofector™ II/2b Device.

### ■ Benefits

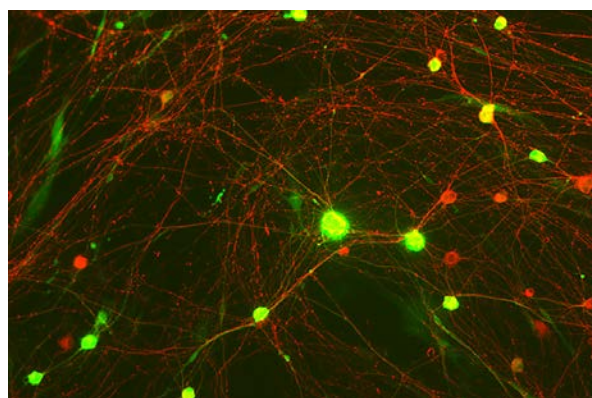
- Transfection efficiency: up to 67% using a non-viral method
- Viability: up to 60%
- Cells retain morphological and functional properties
- Transgene expression for more than one week

### ■ Applications


- Kits suitable for hippocampal neurons, cortical neurons and dorsal root ganglia neurons
- Proven performance for siRNA, shRNA, miRNA, and antisense oligonucleotides

 **New** Nucleofection in adherent state is possible using the AD1 4D-Nucleofector™ Y Kit

- Approaching 250 peer-reviewed publications



Cryopreserved dissociated rat DRG cells were thawed and cultured in 24-well plates for Nucleofection using 4D-Nucleofector™ Y Unit. DRG cell culture was transfected at 2 DIV and fixed 24 hours post Nucleofection (program EH-166). Neuronal networks are stained using anti Tuj-1 antibody (red; personal gift W. Staines). Transfected neurons and Schwann cells can be seen in green [maxGFP™ Protein].

 [www.lonza.com/celldatabase](http://www.lonza.com/celldatabase)  
[www.lonza.com/citations](http://www.lonza.com/citations)

### Ordering Information – Kits

Cat. No. NA	Cat. No. EU	Product Name	Product Description	Size
<b>4D-Nucleofector™ Kits</b>				
V4XP-3012	V4XP-3012	P3 Primary Cell 4D-Nucleofector™ X Kit L	100 µL Nucleocuvette™ Vessel	12 reactions
V4XP-3024	V4XP-3024	P3 Primary Cell 4D-Nucleofector™ X Kit L	100 µL Nucleocuvette™ Vessel	24 reactions
V4XP-3032	V4XP-3032	P3 Primary Cell 4D-Nucleofector™ X Kit S	20 µL Nucleocuvette™ Strip	32 reactions (16-well)
V4YP-1A24	V4YP-1A24	AD1 4D-Nucleofector™ Y Kit	24-well Dipping Electrode	24 reactions
<b>96-well Shuttle™ Kits</b>				
V4SP-3096	V4SP-3096	P3 Primary Cell 96-well Nucleofector™ Kit	20 µL Nucleocuvette™ Plate	96 reactions (96-well)
V4SP-3960	V4SP-3960	P3 Primary Cell 96-well Nucleofector™ Kit	20 µL Nucleocuvette™ Plate	960 reactions (96-well)
<b>384-well Nucleofector™ Kits</b>				
V5SP-3002	V5SP-3002	P3 Primary Cell 384-well Nucleofector™ Kit	20 µL Nucleocuvette™ Plate	768 reactions (384-well)
V5SP-3010	V5SP-3010	P3 Primary Cell 384-well Nucleofector™ Kit	20 µL Nucleocuvette™ Plate	3840 reactions (384-well)
<b>Nucleofector™ II/ 2b Kits</b>				
VAPG-1003	VAPG-1003	Rat Neuron Nucleofector™ II/ 2b Kit	100 µL aluminum cuvette	10 reactions
VPG-1003	VPG-1003	Rat Neuron Nucleofector™ II/ 2b Kit	100 µL aluminum cuvette	25 reactions
VWPG-1003	VWPG-1003	Rat Neuron Nucleofector™ II/ 2b Kit	100 µL aluminum cuvette	4 × 25 reactions
<b>Related Products</b>				<b>Page</b>
Primary Rat Neural Cells				96
PNGM™ Primary Neuron Growth Media BulletKit™				96–97

## Nucleofector™ Kits for Mammalian Neurons

For mammalian neurons lacking a cell-type specific Optimized Protocol, we offer a selection of kits that can be used to easily define optimal Nucleofection Conditions. The P3 Primary Cell Kits together with the cell-group specific Basic Protocols are suited for optimizations of mammalian neurons on the 4D-Nucleofector™ System, the 96-well Shuttle™ system or the 384-well Nucleofector™ System. A cell-group specific Basic Kit is suited for optimization of mammalian neurons using the Nucleofector™ II/2b Device.

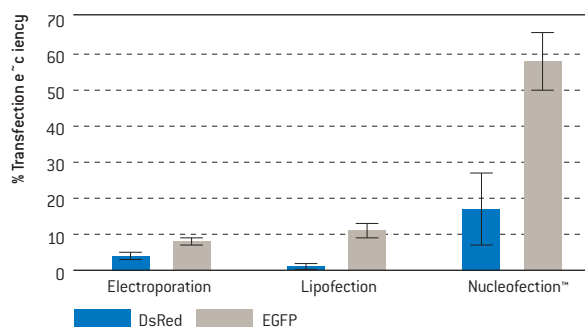
### Benefits

- Optimizations can be performed within one experiment
- Detailed protocols provide guidance through the optimization procedure
- Fine tuning of results is possible with the help of our Scientific Support Team
- Transfection efficiency: up to 92%
- Viability: up to 80%

### Applications

- Kits suited for various neuron types from different mammalian species

**New** Nucleofection in adherent state is possible using the AD1 4D-Nucleofector™ Y Kit



**Comparison of conventional electroporation, lipofection and Nucleofection for transfection of rat neuronal progenitor cells.** Ventral mesencephalic progenitor (VMP) cells from rat brain, which are the important source of dopaminergic neurons for cell replacement strategies in Parkinson's disease, were transfected with two different plasmids expressing DsRed or eGFP. For transfection, conventional electroporation (EasyjetC from EquiBio, 100 µg plasmid per 500,000 cells), lipofection (Lipofectamine™ 2000 Reagent, 0.5 µg DNA per 60,000 cells), or Nucleofection (5 µg DNA per 2,000,000 cells) were used. (Data from Cesnulevicius et al. [2006] Stem Cells 24[12], 2776-91.)

### Ordering Information – Kits

Cat. No. NA	Cat. No. EU	Product Name	Product Description	Size
<b>4D-Nucleofector™ Kits</b>				
V4XP-3012	V4XP-3012	P3 Primary Cell 4D-Nucleofector™ X Kit L	100 µL Nucleocuvette™ Vessel	12 reactions
V4XP-3024	V4XP-3024	P3 Primary Cell 4D-Nucleofector™ X Kit L	100 µL Nucleocuvette™ Vessel	24 reactions
V4XP-3032	V4XP-3032	P3 Primary Cell 4D-Nucleofector™ X Kit S	20 µL Nucleocuvette™ Strip	32 reactions (16-well)
V4YP-1A24	V4YP-1A24	AD1 4D-Nucleofector™ Y Kit	24-well Dipping Electrode	24 reactions
<b>96-well Shuttle™ Kits</b>				
V4SP-3096	V4SP-3096	P3 Primary Cell 96-well Nucleofector™ Kit	20 µL Nucleocuvette™ Plate	96 reactions (96-well)
V4SP-3960	V4SP-3960	P3 Primary Cell 96-well Nucleofector™ Kit	20 µL Nucleocuvette™ Plate	960 reactions (96-well)
<b>384-well Nucleofector™ Kits</b>				
V5SP-3002	V5SP-3002	P3 Primary Cell 384-well Nucleofector™ Kit	20 µL Nucleocuvette™ Plate	768 reactions (384-well)
V5SP-3010	V5SP-3010	P3 Primary Cell 384-well Nucleofector™ Kit	20 µL Nucleocuvette™ Plate	3840 reactions (384-well)
<b>Nucleofector™ II/2b Kits</b>				
VAPI-1003	VAPI-1003	Basic Nucleofector™ II/ 2b Kit for Primary Mammalian Neurons	100 µL aluminum cuvette	10 reactions
VPI-1003	VPI-1003	Basic Nucleofector™ II/ 2b Kit for Primary Mammalian Neurons	100 µL aluminum cuvette	25 reactions
VVPI-1003	VVPI-1003	Basic Nucleofector™ II/ 2b Kit for Primary Mammalian Neurons	100 µL aluminum cuvette	4 × 25 reactions
<b>Related Products</b>				<b>Page</b>
PNGM™ Primary Neural Cell Growth Media BulletKit™				96-97



## Nucleofector™ Kits for Mammalian Glial Cells

A selection of kits for mammalian glial cells helps you to easily define optimal Nucleofection Conditions.

The P3 Primary Cell Kits together with the cell-group specific Basic Protocols are suited for optimizations of mammalian glial cells on the 4D-Nucleofector™ System, the 96-well Shuttle™ System or the 384-well Nucleofector™ System.


A cell-group specific Basic Kit is suited for optimization of mammalian glial cells using the Nucleofector™ II/2b Device.

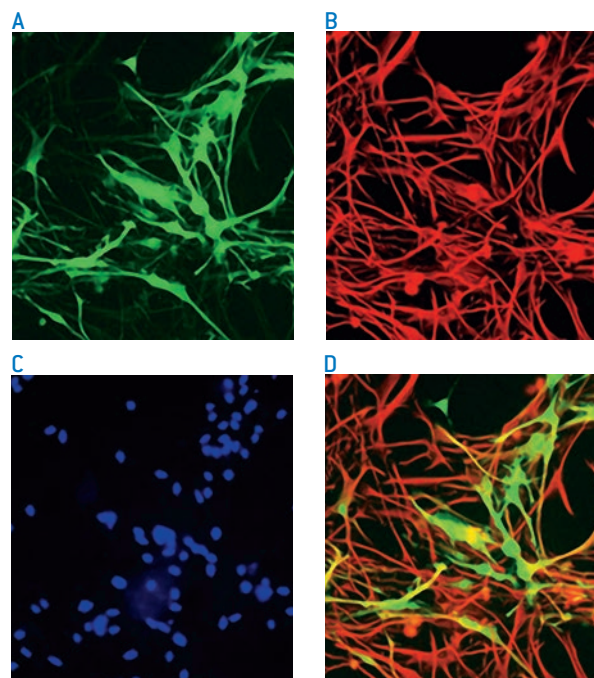
### Benefits

- Optimizations can be performed within one experiment
- Detailed protocols guide through optimization procedure
- Fine tuning of results is possible with the help of our Scientific Support Team
- Transfection efficiency: up to 67%
- Viability: up to 80%

### Applications

- Kits suited for various glial cells from different mammalian species
- Already tested for rat and mouse astrocytes, rat oligodendrocytes

 **Nucleofection in adherent state using the AD1 4D-Nucleofector™ Y Kit**



Expression of GFAP and eGFP in rat astrocytes transfected by Nucleofection. Primary rat astrocytes were isolated from rat embryos [E17] and cultured for 10 days until cells reached confluency. These cells were transfected with a plasmid encoding the enhanced green fluorescent protein, eGFP. 24 hours post Nucleofection, cells were analyzed by fluorescence microscopy for expression of eGFP (A) and GFAP (B), an astrocyte-specific marker protein. Nuclei were stained with DAPI (C). (D) shows an overlay of the images. (Photographs courtesy of Dr. Hyun-Ju Kim and Dr. Tim Vartanian, Beth Israel Deaconess Medical Center, Dept. of Neurology, Boston, Massachusetts, USA.)

### Ordering Information – Kits

Cat. No. NA	Cat. No. EU	Product Name	Product Description	Size
<b>4D-Nucleofector™ Kits</b>				
V4XP-3012	V4XP-3012	P3 Primary Cell 4D-Nucleofector™ X Kit L	100 µL Nucleocuvette™ Vessel	12 reactions
V4XP-3024	V4XP-3024	P3 Primary Cell 4D-Nucleofector™ X Kit L	100 µL Nucleocuvette™ Vessel	24 reactions
V4XP-3032	V4XP-3032	P3 Primary Cell 4D-Nucleofector™ X Kit S	20 µL Nucleocuvette™ Strip	32 reactions (16-well)
V4YP-1A24	V4YP-1A24	AD1 4D-Nucleofector™ Y Kit	24-well Dipping Electrode	24 reactions
<b>96-well Shuttle™ Kits</b>				
V4SP-3096	V4SP-3096	P3 Primary Cell 96-well Nucleofector™ Kit	20 µL Nucleocuvette™ Plate	96 reactions (96-well)
V4SP-3960	V4SP-3960	P3 Primary Cell 96-well Nucleofector™ Kit	20 µL Nucleocuvette™ Plate	960 reactions (96-well)
<b>384-well Nucleofector™ Kits</b>				
V5SP-3002	V5SP-3002	P3 Primary Cell 384-well Nucleofector™ Kit	20 µL Nucleocuvette™ Plate	768 reactions (384-well)
V5SP-3010	V5SP-3010	P3 Primary Cell 384-well Nucleofector™ Kit	20 µL Nucleocuvette™ Plate	3840 reactions (384-well)
<b>Nucleofector™ II/2b Kits</b>				
VAPI-1006	VAPI-1006	Basic Nucleofector™ II/ 2b Kit for Primary Mammalian Glial Cells	100 µL aluminum cuvette	10 reactions
VPI-1006	VPI-1006	Basic Nucleofector™ II/ 2b Kit for Primary Mammalian Glial Cells	100 µL aluminum cuvette	25 reactions
VVPI-1006	VVPI-1006	Basic Nucleofector™ II/ 2b Kit for Primary Mammalian Glial Cells	100 µL aluminum cuvette	4 × 25 reactions

Related Products	Page
Primary Neural Cells and Media	94-96

## Nucleofector™ Kits for Human CD34<sup>+</sup> Cells

Various Nucleofector™ Kits and corresponding Optimized Protocols are available for the transfection of human CD34<sup>+</sup> cells using the different Nucleofection Platforms.

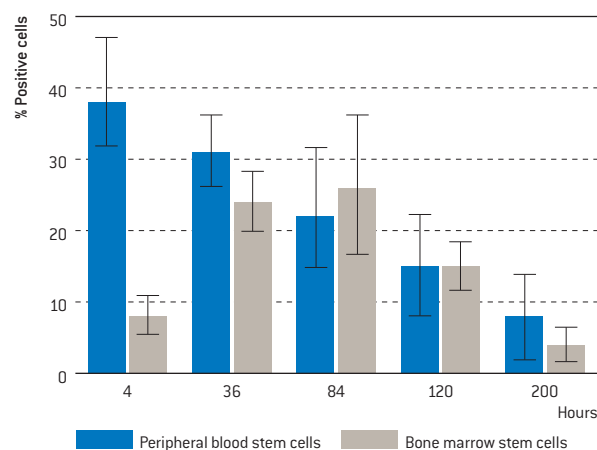
Optimal kits for transfection of human CD34<sup>+</sup> cells in the 4D-Nucleofector™, 96-well Shuttle™ or 384-well Nucleofector™ System are the P3 Primary Cell Kits used in combination with cell-type specific protocols. Human CD34<sup>+</sup> cell specific kits are available for the Nucleofector™ II/2b Device.

### ■ Benefits

- Transfection efficiency: up to 83%
- Viability: up to 70%
- No influence on hematopoietic cell differentiation
- Both fresh or cryopreserved material can be used

### ■ Applications

- Kits suitable for unstimulated human CD34<sup>+</sup> bone marrow cells
- Cells can be derived from cord blood or leukapheresis material
- Cited for DNA and siRNA transfection



**Long-term transgene expression after Nucleofection of blood and bone marrow derived CD34<sup>+</sup> cells.** Kinetics of deltaLNGFR (Low Affinity Nerve Growth Factor Receptor) expression were determined by flow cytometric analysis.  $39 \pm 5.9\%$  of peripheral blood stem cells showed deltaLNGFR staining 4 hours after Nucleofection with a continuous decrease ( $n = 3$ , 3 patients). Bone marrow stem cells showed maximal deltaLNGFR expression with  $26 \pm 9.7\%$  84 hours after transfection, which then decreased in the proliferating culture ( $n = 3$ , single patient). (Data courtesy of Greiner et al., University Hospital of Ulm, Ulm, Germany.)

### Ordering Information – Kits

Cat. No. NA	Cat. No. EU	Product Name	Product Description	Size
<b>4D-Nucleofector™ Kits</b>				
V4XP-3012	V4XP-3012	P3 Primary Cell 4D-Nucleofector™ X Kit L	100 µL Nucleocuvette™ Vessel	12 reactions
V4XP-3024	V4XP-3024	P3 Primary Cell 4D-Nucleofector™ X Kit L	100 µL Nucleocuvette™ Vessel	24 reactions
V4XP-3032	V4XP-3032	P3 Primary Cell 4D-Nucleofector™ X Kit S	20 µL Nucleocuvette™ Strip	32 reactions (16-well)
<b>96-well Shuttle™ Kits</b>				
V4SP-3096	V4SP-3096	P3 Primary Cell 96-well Nucleofector™ Kit	20 µL Nucleocuvette™ Plate	96 reactions (96-well)
V4SP-3960	V4SP-3960	P3 Primary Cell 96-well Nucleofector™ Kit	20 µL Nucleocuvette™ Plate	960 reactions (96-well)
<b>384-well Nucleofector™ Kits</b>				
V5SP-3002	V5SP-3002	P3 Primary Cell 384-well Nucleofector™ Kit	20 µL Nucleocuvette™ Plate	768 reactions (384-well)
V5SP-3010	V5SP-3010	P3 Primary Cell 384-well Nucleofector™ Kit	20 µL Nucleocuvette™ Plate	3840 reactions (384-well)
<b>Nucleofector™ II/2b Kits</b>				
VAPA-1003	VAPA-1003	Human CD34 <sup>+</sup> Cell Nucleofector™ II/ 2b Kit	100 µL aluminum cuvette	10 reactions
VPA-1003	VPA-1003	Human CD34 <sup>+</sup> Cell Nucleofector™ II/ 2b Kit	100 µL aluminum cuvette	25 reactions
VVPA-1003	VVPA-1003	Human CD34 <sup>+</sup> Cell Nucleofector™ II/ 2b Kit	100 µL aluminum cuvette	4 × 25 reactions

Related Products	Page
Human CD34 <sup>+</sup> Progenitor Cells	104
X-VIVO™ 15 Serum-free Hematopoietic Cell Medium – Chemically Defined	141
HPGM™ Hematopoietic Progenitor Growth Medium	104



## Nucleofector™ Kits for Human H9 Stem Cells

Various Nucleofector™ Kits and corresponding Optimized Protocols are available for the transfection of human H9 stem cells using the different Nucleofection Platforms.

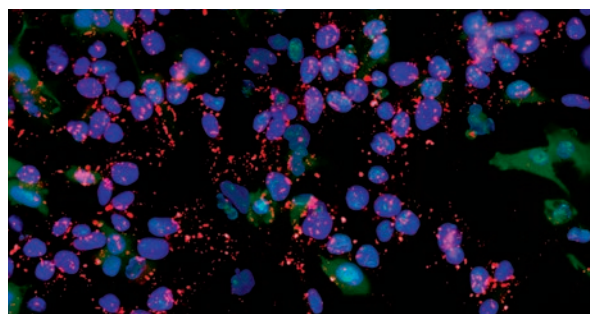
Optimal kits for transfection of human H9 stem cells in the 4D-Nucleofector™, 96-well Shuttle™ or 384-well Nucleofector™ System are the P3 Primary Cell Kits used in combination with cell-type specific protocols. A stem cell specific Basic Kit is suited for optimization of human stem cells using the Nucleofector™ II/2b Device.

### ■ Benefits

- Transfection efficiency: up to 64%
- Viability: up to 98%
- Excellent preservation of pluripotency

### ■ Applications

- Kits suitable for human H9 stem cells
- Elucidate various aspects of stem cell differentiation



H9 cells preserve pluripotency post Nucleofection. H9 cells transfected with the pmaxGFP™ Vector maintain their undifferentiated state. Analysis after 24 hours shows expression of maxGFP™ Protein (green) as well as of the pluripotency markers SSEA4 (red) and Oct4 (purple). The blue signals refer to nuclear staining by DAPI. (Data kindly provided by Jennifer Moore, Rutgers University, Piscataway, USA.)

### Ordering Information – Kits

Cat. No. NA	Cat. No. EU	Product Name	Product Description	Size
<b>4D-Nucleofector™ Kits</b>				
V4XP-3012	V4XP-3012	P3 Primary Cell 4D-Nucleofector™ X Kit L	100 µL Nucleocuvette™ Vessel	12 reactions
V4XP-3024	V4XP-3024	P3 Primary Cell 4D-Nucleofector™ X Kit L	100 µL Nucleocuvette™ Vessel	24 reactions
V4XP-3032	V4XP-3032	P3 Primary Cell 4D-Nucleofector™ X Kit S	20 µL Nucleocuvette™ Strip	32 reactions (16-well)
<b>96-well Shuttle™ Kits</b>				
V4SP-3096	V4SP-3096	P3 Primary Cell 96-well Nucleofector™ Kit	20 µL Nucleocuvette™ Plate	96 reactions (96-well)
V4SP-3960	V4SP-3960	P3 Primary Cell 96-well Nucleofector™ Kit	20 µL Nucleocuvette™ Plate	960 reactions (96-well)
<b>384-well Nucleofector™ Kits</b>				
V5SP-3002	V5SP-3002	P3 Primary Cell 384-well Nucleofector™ Kit	20 µL Nucleocuvette™ Plate	768 reactions (384-well)
V5SP-3010	V5SP-3010	P3 Primary Cell 384-well Nucleofector™ Kit	20 µL Nucleocuvette™ Plate	3840 reactions (384-well)
<b>Nucleofector™ II/2b Kits</b>				
VPH-5002	VPH-5002	Human Stem Cell Nucleofector™ II/ 2b Starter Kit	100 µL aluminum cuvette	18 reactions
VAPH-5012	VAPH-5012	Human Stem Cell Nucleofector™ II/ 2b Kit 1	100 µL aluminum cuvette	10 reactions
VPH-5012	VPH-5012	Human Stem Cell Nucleofector™ II/ 2b Kit 1	100 µL aluminum cuvette	25 reactions
VVPH-5012	VVPH-5012	Human Stem Cell Nucleofector™ II/ 2b Kit 1	100 µL aluminum cuvette	4 × 25 reactions
VAPH-5022	VAPH-5022	Human Stem Cell Nucleofector™ II/ 2b Kit 2	100 µL aluminum cuvette	10 reactions
VPH-5022	VPH-5022	Human Stem Cell Nucleofector™ II/ 2b Kit 2	100 µL aluminum cuvette	25 reactions
VWPH-5022	VWPH-5022	Human Stem Cell Nucleofector™ II/ 2b Kit 2	100 µL aluminum cuvette	4 × 25 reactions

## Nucleofector™ Kits for Human Mesenchymal Stem Cells (MSC)

Various Nucleofector™ Kits and corresponding Optimized Protocols are available for the transfection of human MSC using the different Nucleofection Platforms.

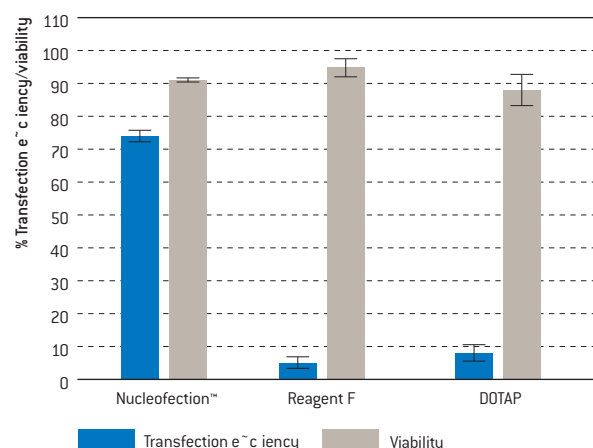
Optimal kits for transfection of human MSC in the 4D-Nucleofector™, 96-well Shuttle™ or 384-well Nucleofector™ System are the P1 Primary Cell Kits used in combination with cell-type specific protocols. Human MSC cell specific kits are available for the Nucleofector™ II/2b Device.

### ■ Benefits

- Transfection efficiency: up to 88%
- Viability: up to 86%
- Maintenance of functional properties
- Efficient non-viral transfection of human MSC

### ■ Applications

- Validated to work with Poietics™ MSC
- Differentiation of transfected MSC into adipocytes or osteoblasts



**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 Fugene® 6 or DOTAP Reagents (both Roche Applied Science). MSC transfected by Nucleofection were analyzed for transfection efficiency roughly 60 hours post Nucleofection, cells transfected with Fugene® 6 or DOTAP 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, Bologna, Italy].

### Ordering Information – Kits

Cat. No. NA	Cat. No. EU	Product Name	Product Description	Size
<b>4D-Nucleofector™ Kits</b>				
V4XP-1012	V4XP-1012	P1 Primary Cell 4D-Nucleofector™ X Kit L	100 µL Nucleocuvette™ Vessel	12 reactions
V4XP-1024	V4XP-1024	P1 Primary Cell 4D-Nucleofector™ X Kit L	100 µL Nucleocuvette™ Vessel	24 reactions
V4XP-1032	V4XP-1032	P1 Primary Cell 4D-Nucleofector™ X Kit S	20 µL Nucleocuvette™ Strip	32 reactions (16-well)
<b>96-well Shuttle™ Kits</b>				
V4SP-1096	V4SP-1096	P1 Primary Cell 96-well Nucleofector™ Kit	20 µL Nucleocuvette™ Plate	96 reactions (96-well)
V4SP-1960	V4SP-1960	P1 Primary Cell 96-well Nucleofector™ Kit	20 µL Nucleocuvette™ Plate	960 reactions (96-well)
<b>384-well Nucleofector™ Kits</b>				
V5SP-1002	V5SP-1002	P1 Primary Cell 384-well Nucleofector™ Kit	20 µL Nucleocuvette™ Plate	768 reactions (384-well)
V5SP-1010	V5SP-1010	P1 Primary Cell 384-well Nucleofector™ Kit	20 µL Nucleocuvette™ Plate	3840 reactions (384-well)
<b>Nucleofector™ II/2b Kits</b>				
VAPE-1001	VAPE-1001	Human Mesenchymal Stem Cell Nucleofector™ II/ 2b Kit	100 µL aluminum cuvette	10 reactions
VPE-1001	VPE-1001	Human Mesenchymal Stem Cell Nucleofector™ II/ 2b Kit	100 µL aluminum cuvette	25 reactions
WPPE-1001	WPPE-1001	Human Mesenchymal Stem Cell Nucleofector™ II/ 2b Kit	100 µL aluminum cuvette	4 × 25 reactions

Related Products	Page
hMSC Human Mesenchymal Stem Cells	29
MSCGM™ Mesenchymal Stem Cell Growth Medium BulletKit™	29
hMSC Mesenchymal Stem Cell Adipogenic Differentiation BulletKit™	30
hMSC Mesenchymal Stem Cell Osteogenic Differentiation BulletKit™	29
hMSC Mesenchymal Stem Cell Chondrogenic Differentiation BulletKit™	29

## Nucleofector™ Kits for Human Pluripotent Stem Cells

For human pluripotent stem cells (ESC or iPSC), lacking a cell-type specific Optimized Protocol, we offer a selection of kits that can be used to easily define optimal Nucleofection Conditions.

The P3 and P4 Primary Cell Kits together with the cell-group specific Basic Protocols are suited for optimizations of human stem cells on the 4D-Nucleofector™ System, the 96-well Shuttle™ System or the 384-well Nucleofector™ System.

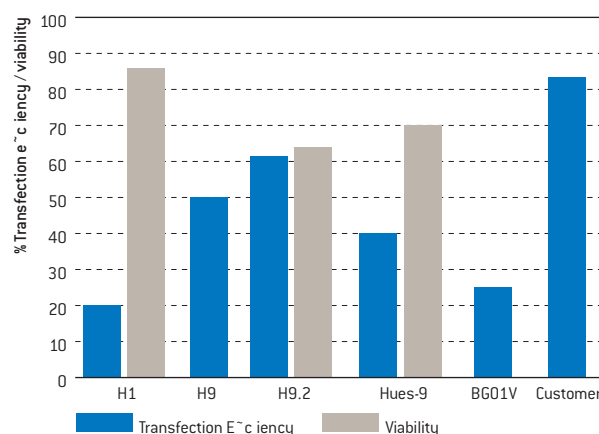
A cell-group specific Basic Kit is suited for optimization of human stem cells using the Nucleofector™ II/2b Device.

### ■ Benefits

- Transfection efficiency: up to 95%
- Viability: up to 98%
- Circumvents tedious creation of viruses
- Less DNA and lower cell number required

### ■ Applications

- Already tested for various human ESC clone (e.g. H1, H9, H14 or HS306) and iPSCs
- Proven for ZFN, TALEN or CRISPR mediated genome editing in human ESCs or iPSCs



**Transfection efficiencies of human stem cell lines.** Different human stem cell lines were transfected by Nucleofection using the pmaxGFP™ Vector. [Data for Nucleofection of human stem cells are compiled from experiments performed by leading stem cell research customers.]

 [www.lonza.com/genome-editing](http://www.lonza.com/genome-editing)

### Ordering Information – Kits

Cat. No. NA	Cat. No. EU	Product Name	Product Description	Size
<b>4D-Nucleofector™ Kits</b>				
V4XP-3012	V4XP-3012	P3 Primary Cell 4D-Nucleofector™ X Kit L	100 µL Nucleocuvette™ Vessel	12 reactions
V4XP-3024	V4XP-3024	P3 Primary Cell 4D-Nucleofector™ X Kit L	100 µL Nucleocuvette™ Vessel	24 reactions
V4XP-3032	V4XP-3032	P3 Primary Cell 4D-Nucleofector™ X Kit S	20 µL Nucleocuvette™ Strip	32 reactions (16-well)
V4XP-4012	V4XP-4012	P4 Primary Cell 4D-Nucleofector™ X Kit L	100 µL Nucleocuvette™ Vessel	12 reactions
V4XP-4024	V4XP-4024	P4 Primary Cell 4D-Nucleofector™ X Kit L	100 µL Nucleocuvette™ Vessel	24 reactions
V4XP-4032	V4XP-4032	P4 Primary Cell 4D-Nucleofector™ X Kit S	20 µL Nucleocuvette™ Strip	32 reactions (16-well)
<b>96-well Shuttle™ Kits</b>				
V4SP-3096	V4SP-3096	P3 Primary Cell 96-well Nucleofector™ Kit	20 µL Nucleocuvette™ Plate	96 reactions (96-well)
V4SP-3960	V4SP-3960	P3 Primary Cell 96-well Nucleofector™ Kit	20 µL Nucleocuvette™ Plate	960 reactions (96-well)
V4SP-4096	V4SP-4096	P4 Primary Cell 96-well Nucleofector™ Kit	20 µL Nucleocuvette™ Plate	96 reactions (96-well)
V4SP-4960	V4SP-4960	P4 Primary Cell 96-well Nucleofector™ Kit	20 µL Nucleocuvette™ Plate	960 reactions (96-well)
<b>384-well Nucleofector™ Kits</b>				
V5SP-3002	V5SP-3002	P3 Primary Cell 384-well Nucleofector™ Kit	20 µL Nucleocuvette™ Plate	768 reactions (384-well)
V5SP-3010	V5SP-3010	P3 Primary Cell 384-well Nucleofector™ Kit	20 µL Nucleocuvette™ Plate	3840 reactions (384-well)
V5SP-4002	V5SP-4002	P4 Primary Cell 384-well Nucleofector™ Kit	20 µL Nucleocuvette™ Plate	768 reactions (384-well)
V5SP-4010	V5SP-4010	P4 Primary Cell 384-well Nucleofector™ Kit	20 µL Nucleocuvette™ Plate	3840 reactions (384-well)
<b>Nucleofector™ II/ 2b Kits</b>				
VPH-5002	VPH-5002	Human Stem Cell Nucleofector™ II/ 2b Starter Kit	100 µL aluminum cuvette	18 reactions
VAPH-5012	VAPH-5012	Human Stem Cell Nucleofector™ II/ 2b Kit 1	100 µL aluminum cuvette	10 reactions
VPH-5012	VPH-5012	Human Stem Cell Nucleofector™ II/ 2b Kit 1	100 µL aluminum cuvette	25 reactions
VVPH-5012	VVPH-5012	Human Stem Cell Nucleofector™ II/ 2b Kit 1	100 µL aluminum cuvette	4 × 25 reactions
VAPH-5022	VAPH-5022	Human Stem Cell Nucleofector™ II/ 2b Kit 2	100 µL aluminum cuvette	10 reactions
VPH-5022	VPH-5022	Human Stem Cell Nucleofector™ II/ 2b Kit 2	100 µL aluminum cuvette	25 reactions
VWPH-5022	VWPH-5022	Human Stem Cell Nucleofector™ II/ 2b Kit 2	100 µL aluminum cuvette	4 × 25 reactions

## Nucleofector™ Kits 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.

### ■ Benefits

- Simple, single-step procedure to introduce DNA/RNA, e.g. episomal vectors
- Successfully tested for generation of iPSCs from various cell types
- Availability of 4D-Nucleofector™ Kits with GMP Solutions

### ■ Applications

- Reprogramming of various cell types, including PBMCs, CD34<sup>+</sup> hematopoietic stem cells or fibroblasts

To determine the required Nucleofector™ Kit for your reprogramming cell type of interest please refer to the respective Nucleofector™ Kit page.

### Selected Publications

ADSCs	Jia <i>et al.</i> [2010] Nature Methods 7:197-199
	Yu J <i>et al.</i> [2011] PLoS ONE 6(3): e17557
BMMCs or PBMCs	Chou BK <i>et al.</i> [2011] Cell Research 21:518-529
	Hu K <i>et al.</i> [2011] Blood 117(14): e109-e119
	Li Y <i>et al.</i> [2016] Stem Cell Rep 7:31
CD34 <sup>+</sup> Cells	Baghbaderani <i>et al.</i> [2015] Stem Cell Rep 5(4):647-59
	Ben Nun IF [2013] Lonza Resource Notes, Spring: 8-11
	Chou BK <i>et al.</i> [2011] Cell Research 21:518-529
	Chou <i>et al.</i> [2015] Stem Cells Transl Med 4(4):320-32
	Mack A <i>et al.</i> [2011] PLoS ONE 6(11): e27956
	Margariti <i>et al.</i> [2012] PNAS 109(34):13793–13798
	Yu J <i>et al.</i> [2011] PLoS ONE 6(3): e17557
DPSCs	Chen <i>et al.</i> [2013] PLoS ONE 8(10): e75682
Fibroblast	Arnold <i>et al.</i> [2012] ISRN Cell Biol, Article ID 124878
	Carter <i>et al.</i> [2016] Sci Rep 22(6):33792
	Chen <i>et al.</i> [2013] PLoS ONE 8(10): e75682
	Goyal <i>et al.</i> [2013] PLoS ONE 8(12): e82838
	Lin <i>et al.</i> [2016] BMC Syst Biol 10: 105
	Manzini <i>et al.</i> [2015] Stem Cell Rev 11(6):900-8
	Mehta A <i>et al.</i> [2011] Cardiovasc Res 91:577-86
	Olsen <i>et al.</i> [2012] Lonza Resource Notes, Fall: 9-12
	Yu J <i>et al.</i> [2009] Science 324(5928):797-801
	Zhu <i>et al.</i> [2015] Nat Prot 10(7):959-73
MEFs	Kaji K <i>et al.</i> [2009] Nature 458(7239):771-775
Urine Cells	Li D <i>et al.</i> [2016] Stem Cell Rep 6(5):717-728

### Ordering Information

Cat. No. NA	Cat. No. EU	Product Name	Product Description	Size
CC-2702	CC-2702	hPBMC – Human Peripheral Blood Mononuclear Cells	Cryopreserved, volume discount available	≥ 50 million cells/vial
V4XP-3012	V4XP-3012	P3 Primary Cell 4D-Nucleofector™ X Kit L	100 µL Nucleocuvette™ Vessel	12 reactions

Related Products	Page
Human Peripheral Blood Mononuclear Cells	104
4D-Nucleofector™ System	190

## Nucleofector™ Kits for Mouse Embryonic Stem (ES) Cells

Various Nucleofector™ Kits and corresponding Optimized Protocols are available for the transfection of mouse ES cells using the different Nucleofection Platforms.

Optimal kits for transfection of mouse ES cells in the 4D-Nucleofector™, 96-well Shuttle™ or 384-well Nucleofector™ System are the P3 Primary Cell Kits used in combination with cell-type specific protocols. Mouse ES cell specific kits are available for the Nucleofector™ II/2b Device.

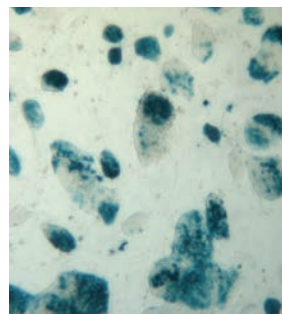
### ■ Benefits

- Transfection efficiency: up to 90%
- Viability: up to 99%
- Homogenous transient gene expression pattern
- Preservation of cell functionality (ability to differentiate)

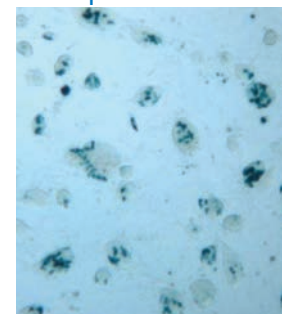
### ■ Applications

- Tested with several mouse ES cell lines (e.g., R1, D3, E14)
- Successfully used to generate germline chimeras

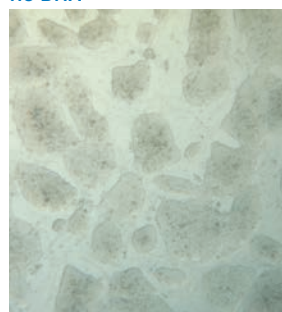
### Nucleofection



### Electroporation



### no DNA



**Comparison of Nucleofection and electroporation for transfection of mouse ES cells.** Mouse ES cells were transfected by Nucleofection and compared to mock-transfected (no DNA) and electroporated ES cells using Bio-Rad® Gene Pulser®. Cells were stained 48 hours after transfection for transient lacZ expression. [Data courtesy of S. Boljahn, A. Rode, M. Joao da Silva, T. Hennek and B. Zevnik, Artemis Pharmaceutical GmbH, Cologne, Germany.]

### Ordering Information – Kits

Cat. No. NA	Cat. No. EU	Product Name	Product Description	Size
<b>4D-Nucleofector™ Kits</b>				
V4XP-3012	V4XP-3012	P3 Primary Cell 4D-Nucleofector™ X Kit L	100 µL Nucleocuvette™ Vessel	12 reactions
V4XP-3024	V4XP-3024	P3 Primary Cell 4D-Nucleofector™ X Kit L	100 µL Nucleocuvette™ Vessel	24 reactions
V4XP-3032	V4XP-3032	P3 Primary Cell 4D-Nucleofector™ X Kit S	20 µL Nucleocuvette™ Strip	32 reactions (16-well)
<b>96-well Shuttle™ Kits</b>				
V4SP-3096	V4SP-3096	P3 Primary Cell 96-well Nucleofector™ Kit	20 µL Nucleocuvette™ Plate	96 reactions (96-well)
V4SP-3960	V4SP-3960	P3 Primary Cell 96-well Nucleofector™ Kit	20 µL Nucleocuvette™ Plate	960 reactions (96-well)
<b>384-well Nucleofector™ Kits</b>				
V5SP-3002	V5SP-3002	P3 Primary Cell 384-well Nucleofector™ Kit	20 µL Nucleocuvette™ Plate	768 reactions (384-well)
V5SP-3010	V5SP-3010	P3 Primary Cell 384-well Nucleofector™ Kit	20 µL Nucleocuvette™ Plate	3840 reactions (384-well)
<b>Nucleofector™ II/ 2b Kits</b>				
VAPH-1001	VAPH-1001	Mouse Embryonic Stem Cell Nucleofector™ II/ 2b Kit	100 µL aluminum cuvette	10 reactions
VPH-1001	VPH-1001	Mouse Embryonic Stem Cell Nucleofector™ II/ 2b Kit	100 µL aluminum cuvette	25 reactions
WPH-1001	WPH-1001	Mouse Embryonic Stem Cell Nucleofector™ II/ 2b Kit	100 µL aluminum cuvette	4 × 25 reactions

### Related Products

Related Products	Page
Mouse Embryonic Fibroblasts (as feeder cells)	93
DMEM 4.5 g/L glucose with L-Glutamine	124

## Nucleofector™ Kits for Mouse Neural Stem Cells (NSC)

Various Nucleofector™ Kits and corresponding Optimized Protocols are available for the transfection of mouse NSC using the different Nucleofection Platforms.

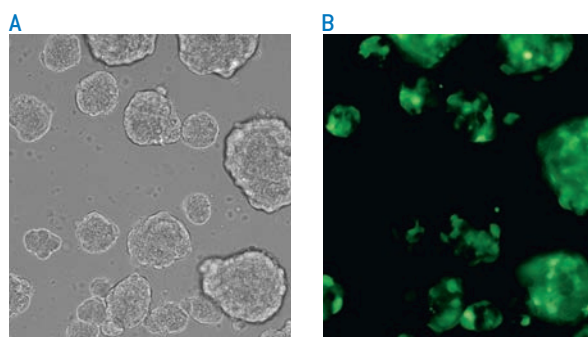
For the transfection of mouse NSC in the 4D-Nucleofector™, 96-well Shuttle™ or 384-well Nucleofector™ System we recommend using the P3 Primary Cell Kits and the respective optimization protocols. Optimal Nucleofection Conditions are transferable between these three systems. Mouse NSC specific kits are available for the Nucleofector™ II/2b Device.

### ■ Benefits

- Transfection efficiency: up to 82%
- Viability: up to 90%
- Transgene expression for several days

### ■ Applications

- Kits suitable for mouse neurospheres and adherent cells
- Differentiation into neurons and astrocytes possible



**Nucleofection of mouse NSCs.** Primary NSCs isolated from the lateral ventricular wall of an adult mouse were transfected by Nucleofection using a plasmid encoding the enhanced green fluorescent protein eGFP. 48 hours post Nucleofection, the cells were analyzed by light [A] and fluorescence microscopy [B]. [Photograph courtesy of Dr. L. Wikstrom et al., NeuroNova, Stockholm, Sweden.]

### Ordering Information – Kits

Cat. No. NA	Cat. No. EU	Product Name	Product Description	Size
<b>4D-Nucleofector™ Kits</b>				
V4XP-3012	V4XP-3012	P3 Primary Cell 4D-Nucleofector™ X Kit L	100 µL Nucleocuvette™ Vessel	12 reactions
V4XP-3024	V4XP-3024	P3 Primary Cell 4D-Nucleofector™ X Kit L	100 µL Nucleocuvette™ Vessel	24 reactions
V4XP-3032	V4XP-3032	P3 Primary Cell 4D-Nucleofector™ X Kit S	20 µL Nucleocuvette™ Strip	32 reactions (16-well)
<b>96-well Shuttle™ Kits</b>				
V4SP-3096	V4SP-3096	P3 Primary Cell 96-well Nucleofector™ Kit	20 µL Nucleocuvette™ Plate	96 reactions (96-well)
V4SP-3960	V4SP-3960	P3 Primary Cell 96-well Nucleofector™ Kit	20 µL Nucleocuvette™ Plate	960 reactions (96-well)
<b>384-well Nucleofector™ Kits</b>				
V5SP-3002	V5SP-3002	P3 Primary Cell 384-well Nucleofector™ Kit	20 µL Nucleocuvette™ Plate	768 reactions (384-well)
V5SP-3010	V5SP-3010	P3 Primary Cell 384-well Nucleofector™ Kit	20 µL Nucleocuvette™ Plate	3840 reactions (384-well)
<b>Nucleofector™ II/ 2b Kits</b>				
VAPG-1004	VAPG-1004	Mouse Neural Stem Cell Nucleofector™ II/ 2b Kit	100 µL aluminum cuvette	10 reactions
VPG-1004	VPG-1004	Mouse Neural Stem Cell Nucleofector™ II/ 2b Kit	100 µL aluminum cuvette	25 reactions
WPG-1004	WPG-1004	Mouse Neural Stem Cell Nucleofector™ II/ 2b Kit	100 µL aluminum cuvette	4 × 25 reactions

## Nucleofector™ Kits for Rat Neural Stem Cells (NSC)

Various Nucleofector™ Kits and corresponding Optimized Protocols are available for the transfection of rat NSC using the different Nucleofection Platforms.

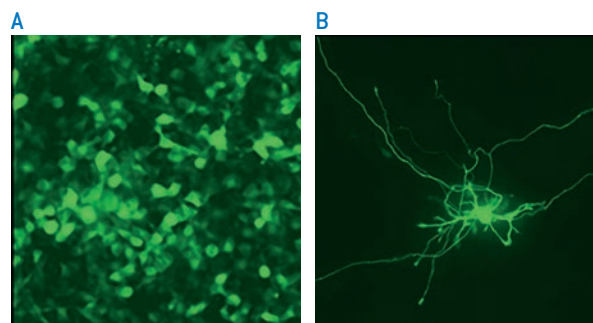
For the transfection of rat NSC in the 4D-Nucleofector™, 96-well Shuttle™ or 384-well Nucleofector™ System we recommend using the Primary Cell Optimization Kits and the respective optimization protocols. Optimal Nucleofection Conditions are transferable between these three systems. Rat NSC specific kits are available for the Nucleofector™ II/2b Device.

### ■ Benefits

- Transfection efficiency: up to 46%
- Efficient non-viral method for efficient gene transfer into primary neural stem cells
- Transgene expression for several days

### ■ Applications

- Kits suitable for rat neurospheres and adherent cells
- Differentiation into neurons and astrocytes possible



**Nucleofection of rat NSC.** Primary NSC isolated from rat embryos (E14) were transfected by Nucleofection using a plasmid encoding enhanced green fluorescent protein eGFP under control of an EF1alpha promoter (pcDNAEF1-eGFP). Post Nucleofection, cells were cultured with bFGF for 2 days, then for 5 additional days without bFGF to differentiate into neurons. Cells were analyzed 2 days (A) and 7 days (B) post Nucleofection by fluorescence microscopy. (Photograph courtesy of S.H. Lee, College of Medicine, Dept. of Biochemistry, Hanyang University, Seoul, South Korea.)

### Ordering Information – Kits

Cat. No. NA	Cat. No. EU	Product Name	Product Description	Size
<b>4D-Nucleofector™ Kits</b>				
V4XP-9096	V4XP-9096	Primary Cell Optimization 4D-Nucleofector™ X Kit	20 µL Nucleocuvette™ Strip	96 reactions (16-well)
<b>96-well Shuttle™ Kits</b>				
V4SP-9096	V4SP-9096	Primary Cell Optimization 96-well Nucleofector™ Kit	20 µL Nucleocuvette™ Plate	160 reactions (96-well)
<b>384-well Nucleofector™ Kits</b>				
V5SP-9001	V5SP-9001	Primary Cell Optimization 384-well Nucleofector™ Kit	20 µL Nucleocuvette™ Plate	384 reactions (384-well)
<b>Nucleofector™ II/ 2b Kits</b>				
VPG-1005	VPG-1005	Rat Neural Stem Cell Nucleofector™ II/ 2b Kit	100 µL aluminum cuvette	25 reactions
WPG-1005	WPG-1005	Rat Neural Stem Cell Nucleofector™ II/ 2b Kit	100 µL aluminum cuvette	4 × 25 reactions



## Nucleofector™ Kits for Animal Stem Cells

For animal stem cells lacking a cell-type specific Optimized Protocol, we offer a selection of kits that can be used to easily define optimal Nucleofection Conditions.

The Primary Cell Optimization Kits are suited for optimizations of stem cells on the 4D-Nucleofector™ System, the 96-well Shuttle™ System or the 384-well Nucleofector™ System.

### ■ Benefits

- Protocols provide guidance through the optimization procedure
- Optimizations can be performed within one experiment
- Fine tuning of results is possible with the help of our Scientific Support Team

### ■ Applications

- Kits suited for stem cells from different mammalian species and various organs

### Ordering Information – Kits

Cat. No. NA	Cat. No. EU	Product Name	Product Description	Size
<b>4D-Nucleofector™ Kits</b>				
V4XP-9096	V4XP-9096	Primary Cell Optimization 4D-Nucleofector™ X Kit	20 µL Nucleocuvette™ Strip	96 reactions (16-well)
<b>96-well Shuttle™ Kits</b>				
V4SP-9096	V4SP-9096	Primary Cell Optimization 96-well Nucleofector™ Kit	20 µL Nucleocuvette™ Plate	160 reactions (96-well)
<b>384-well Nucleofector™ Kits</b>				
V5SP-9001	V5SP-9001	Primary Cell Optimization 384-well Nucleofector™ Kit	20 µL Nucleocuvette™ Plate	384 reactions (384-well)

Related Products	Page
Nucleofector™ Kits for Human Stem Cells	242,244

## Cell Line Kits for 4D-Nucleofector™ X Unit, 96-well Shuttle™ and 384-well Nucleofector™ Systems

We offer three different Cell Line Nucleofector™ Solutions SE, SF and SG for the 4D-Nucleofector™, X Unit, 96-well Shuttle™ and the 384-well Nucleofector™ Systems.

### Each Cell Line Kit Contains

- Specific Nucleofector™ Solution SE, SF or SG
- Supplement
- pmaxGFP™ Control Vector
- Either single 100 µL Nucleocuvettes™, 16-well Nucleocuvette™ Strips, 96-well or 384-well Nucleocuvette™ Plates


All kits are available in various sizes (please refer to ordering information for details). Optimized Protocols outlining the optimal Nucleofector™ Kit for a broad selection of cell lines are available and can be downloaded from our website. You can always find the most up-to-date information in our online cell database.

### Benefits

- Each of the three Nucleofector™ Solutions can be used for a selection of different cell lines
- Conditions are transferable between 4D-Nucleofector™, 96-well Shuttle™ and 384-well Nucleofector™ Systems and between 20 and 100 µL Nucleocuvettes™

### Applications

- Transfection of lower cell numbers (from  $2 \times 10^4$  to  $1 \times 10^6$  cells) to higher cell numbers (from  $2 \times 10^5$  to  $2 \times 10^7$  cells) is possible
- Flexible throughput from single cuvette (100 µL) to 16-well Nucleocuvette™ Strip (20 µL), 96-well and 384-well Nucleocuvette™ Plates is possible

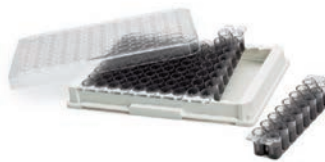
 [www.lonza.com/celldatabase](http://www.lonza.com/celldatabase)  
[www.lonza.com/protocols](http://www.lonza.com/protocols)

100 µL Nucleocuvette™  
(4D-Nucleofector™ System)

16-well Nucleocuvette™ Strip  
(4D-Nucleofector™ System)

96-well Nucleocuvette™ Plate  
(96-well Shuttle™ System)

384-well Nucleocuvette™ Plate  
(384-well Nucleofector™ System)



### Ordering Information – Kits

Cat. No. NA	Cat. No. EU	Product Name	Product Description	Size
<b>Cell Line Kits for 4D-Nucleofector™, 96-well Shuttle™ and 384-well Nucleofector™ Systems</b>				
V4XC-1012	V4XC-1012	SE Cell Line 4D-Nucleofector™ X Kit L	100 µL Nucleocuvette™ Vessel	12 reactions
V4XC-1024	V4XC-1024	SE Cell Line 4D-Nucleofector™ X Kit L	100 µL Nucleocuvette™ Vessel	24 reactions
V4XC-1032	V4XC-1032	SE Cell Line 4D-Nucleofector™ X Kit S	20 µL Nucleocuvette™ Strip	32 reactions (16-well)
V4XC-2012	V4XC-2012	SF Cell Line 4D-Nucleofector™ X Kit L	100 µL Nucleocuvette™ Vessel	12 reactions
V4XC-2024	V4XC-2024	SF Cell Line 4D-Nucleofector™ X Kit L	100 µL Nucleocuvette™ Vessel	24 reactions
V4XC-2032	V4XC-2032	SF Cell Line 4D-Nucleofector™ X Kit S	20 µL Nucleocuvette™ Strip	32 reactions (16-well)
V4XC-3012	V4XC-3012	SG Cell Line 4D-Nucleofector™ X Kit L	100 µL Nucleocuvette™ Vessel	12 reactions
V4XC-3024	V4XC-3024	SG Cell Line 4D-Nucleofector™ X Kit L	100 µL Nucleocuvette™ Vessel	24 reactions
V4XC-3032	V4XC-3032	SG Cell Line 4D-Nucleofector™ X Kit S	20 µL Nucleocuvette™ Strip	32 reactions (16-well)
<b>Cell Line Kits for 4D-Nucleofector™, 96-well Shuttle™ and 384-well Nucleofector™ Systems</b>				
V4SC-1096	V4SC-1096	SE Cell Line 96-well Nucleofector™ Kit	20 µL Nucleocuvette™ Plate	96 reactions (96-well)
V4SC-1960	V4SC-1960	SE Cell Line 96-well Nucleofector™ Kit	20 µL Nucleocuvette™ Plate	960 reactions (96-well)
V4SC-2096	V4SC-2096	SF Cell Line 96-well Nucleofector™ Kit	20 µL Nucleocuvette™ Plate	96 reactions (96-well)
V4SC-2960	V4SC-2960	SF Cell Line 96-well Nucleofector™ Kit	20 µL Nucleocuvette™ Plate	960 reactions (96-well)
V4SC-3096	V4SC-3096	SG Cell Line 96-well Nucleofector™ Kit	20 µL Nucleocuvette™ Plate	96 reactions (96-well)
V4SC-3960	V4SC-3960	SG Cell Line 96-well Nucleofector™ Kit	20 µL Nucleocuvette™ Plate	960 reactions (96-well)

# Cell Line Kits for 4D-Nucleofector™ X Unit, 96-well Shuttle™ and 384-well Nucleofector™ Systems

Continued

## Ordering Information – Kits

Cat. No. NA	Cat. No. EU	Product Name	Product Description	Size
<b>Cell Line Kits for 4D-Nucleofector™, 96-well Shuttle™ and 384-well Nucleofector™ Systems</b>				
V5SC-1002	V5SC-1002	SE Cell Line 384-well Nucleofector™ Kit	20 µL Nucleocuvette™ Plate	768 reactions (384-well)
V5SC-1010	V5SC-1010	SE Cell Line 384-well Nucleofector™ Kit	20 µL Nucleocuvette™ Plate	3840 reactions (384-well)
V5SC-2002	V5SC-2002	SF Cell Line 384-well Nucleofector™ Kit	20 µL Nucleocuvette™ Plate	768 reactions (384-well)
V5SC-2010	V5SC-2010	SF Cell Line 384-well Nucleofector™ Kit	20 µL Nucleocuvette™ Plate	3840 reactions (384-well)
V5SC-3002	V5SC-3002	SG Cell Line 384-well Nucleofector™ Kit	20 µL Nucleocuvette™ Plate	768 reactions (384-well)
V5SC-3010	V5SC-3010	SG Cell Line 384-well Nucleofector™ Kit	20 µL Nucleocuvette™ Plate	3840 reactions (384-well)

## Quick Reference Guide – Cell Line Kits

Cell line	Efficiency	Viable cells	Solution	Kits for 4D-Nucleofector™ (Cat. No.)			Kits for 96-well Shuttle™ (Cat. No.)	
				100 µL (12 rxn) Cat. No.	100 µL (24 rxn) Cat. No.	20 µL (32 rxn) Cat. No.	20 µL (96 rxn) Cat. No.	20 µL (960 rxn) Cat. No.
293	83%	93%	SF	V4XC-2012	V4XC-2024	V4XC-2032	V4SC-2096	V4SC-2960
3T3-L1 pre-ad	97%	66–79%	SE	V4XC-1012	V4XC-1024	V4XC-1032	V4SC-1096	V4SC-1960
A20	98%	65–76%	SF	V4XC-2012	V4XC-2024	V4XC-2032	V4SC-2096	V4SC-2960
A549	81%	62%	SF	V4XC-2012	V4XC-2024	V4XC-2032	V4SC-2096	V4SC-2960
ARPE-19	95–100%	82–100%	SF	V4XC-2012	V4XC-2024	V4XC-2032	V4SC-2096	V4SC-2960
Ba / F3	80%	60–70%	SG	V4XC-3012	V4XC-3024	V4XC-3032	V4SC-3096	V4SC-3960
Beta TC-6	66–77%	49–82%	SF	V4XC-2012	V4XC-2024	V4XC-2032	V4SC-2096	V4SC-2960
BHK-21	97–98%	91–95%	SG	V4XC-3012	V4XC-3024	V4XC-3032	V4SC-3096	V4SC-3960
C6	92%	55–70%	SF	V4XC-2012	V4XC-2024	V4XC-2032	V4SC-2096	V4SC-2960
CHO-K1	86%	97%	SF	V4XC-2012	V4XC-2024	V4XC-2032	V4SC-2096	V4SC-2960
CHO-S [suspension]	86%	55–57%	SG	V4XC-3012	V4XC-3024	V4XC-3032	V4SC-3096	V4SC-3960
COS-7	91–99%	80–96%	SE	V4XC-1012	V4XC-1024	V4XC-1032	V4SC-1096	V4SC-1960
DU 145	89%	86–92%	SE	V4XC-1012	V4XC-1024	V4XC-1032	V4SC-1096	V4SC-1960
EL4	70–80%		SE	V4XC-1012	V4XC-1024	V4XC-1032	V4SC-1096	V4SC-1960
GH3	73–83%	58–77%	SE	V4XC-1012	V4XC-1024	V4XC-1032	V4SC-1096	V4SC-1960
H9C2	80–90%	54–72%	SF	V4XC-2012	V4XC-2024	V4XC-2032	V4SC-2096	V4SC-2960
HCT 116	70–80%	65–75%	SE	V4XC-1012	V4XC-1024	V4XC-1032	V4SC-1096	V4SC-1960
HeLa	75%	89%	SE	V4XC-1012	V4XC-1024	V4XC-1032	V4SC-1096	V4SC-1960
HeLa S3	61–85%	62–95%	SE	V4XC-1012	V4XC-1024	V4XC-1032	V4SC-1096	V4SC-1960
Hep G2	95.50%	92.70%	SF	V4XC-2012	V4XC-2024	V4XC-2032	V4SC-2096	V4SC-2960
HL-60	58%	61%	SF	V4XC-2012	V4XC-2024	V4XC-2032	V4SC-2096	V4SC-2960
HT29	51–67%	60%	SF	V4XC-2012	V4XC-2024	V4XC-2032	V4SC-2096	V4SC-2960
IMR32	74–86%	45–63%	SF	V4XC-2012	V4XC-2024	V4XC-2032	V4SC-2096	V4SC-2960
IMR90	65%	70%	SE	V4XC-1012	V4XC-1024	V4XC-1032	V4SC-1096	V4SC-1960
Jurkat	92%	71–80%	SE	V4XC-1012	V4XC-1024	V4XC-1032	V4SC-1096	V4SC-1960
K-562	92%	95%	SF	V4XC-2012	V4XC-2024	V4XC-2032	V4SC-2096	V4SC-2960
L-428	70–80%	85%	SF	V4XC-2012	V4XC-2024	V4XC-2032	V4SC-2096	V4SC-2960
LnCAP	70%	45%	SF	V4XC-2012	V4XC-2024	V4XC-2032	V4SC-2096	V4SC-2960
MCF7	72%	89%	SE	V4XC-1012	V4XC-1024	V4XC-1032	V4SC-1096	V4SC-1960
MDA-MB-231	71–76%	57–69%	SE	V4XC-1012	V4XC-1024	V4XC-1032	V4SC-1096	V4SC-1960
MDCK	72–82%	50–55%	SE	V4XC-1012	V4XC-1024	V4XC-1032	V4SC-1096	V4SC-1960
MG63	70–73%	60–65%	SE	V4XC-1012	V4XC-1024	V4XC-1032	V4SC-1096	V4SC-1960
MRC-5	84–86%	67–73%	SE	V4XC-1012	V4XC-1024	V4XC-1032	V4SC-1096	V4SC-1960

# Cell Line Kits for 4D Nucleofector™ X Unit, 96-well Shuttle™ and 384-well Nucleofector™ Systems

Continued

## Quick Reference Guide – Cell Line Kits

Cell line	Efficiency	Viable cells	Solution	Kits for 4D-Nucleofector™ (Cat. No.)			Kits for 96-well Shuttle™ (Cat. No.)	
				100 µL (12 rxn) Cat. No.	100 µL (24 rxn) Cat. No.	20 µL (32 rxn) Cat. No.	20 µL (96 rxn) Cat. No.	20 µL (960 rxn) Cat. No.
Neuro-2a [N2a]	67%	82%	SF	V4XC-2012	V4XC-2024	V4XC-2032	V4SC-2096	V4SC-2960
NIH/3T3	95%	93%	SG	V4XC-3012	V4XC-3024	V4XC-3032	V4SC-3096	V4SC-3960
PC3	83%	79%	SF	V4XC-2012	V4XC-2024	V4XC-2032	V4SC-2096	V4SC-2960
Raji	65–69%	71%	SG	V4XC-3012	V4XC-3024	V4XC-3032	V4SC-3096	V4SC-3960
Ramos	40–51%	70–77%	SG	V4XC-3012	V4XC-3024	V4XC-3032	V4SC-3096	V4SC-3960
RAW 264.7	60%	86%	SF	V4XC-2012	V4XC-2024	V4XC-2032	V4SC-2096	V4SC-2960
RIN-m5F	68–90%	71–85%	SF	V4XC-2012	V4XC-2024	V4XC-2032	V4SC-2096	V4SC-2960
Sf9	58–80%	76–82%	SF	V4XC-2012	V4XC-2024	V4XC-2032	V4SC-2096	V4SC-2960
SH-SY5Y	81%	80%	SF	V4XC-2012	V4XC-2024	V4XC-2032	V4SC-2096	V4SC-2960
Sp2-0	65–69%	80–90%	SF	V4XC-2012	V4XC-2024	V4XC-2032	V4SC-2096	V4SC-2960
T-47D	72–87%	64–76%	SE	V4XC-1012	V4XC-1024	V4XC-1032	V4SC-1096	V4SC-1960
T84	88%	50–70%	SF	V4XC-2012	V4XC-2024	V4XC-2032	V4SC-2096	V4SC-2960
THP-1	65%	81%	SG	V4XC-3012	V4XC-3024	V4XC-3032	V4SC-3096	V4SC-3960
U-87MG	75%	40–50%	SE	V4XC-1012	V4XC-1024	V4XC-1032	V4SC-1096	V4SC-1960
U-937	36%	85%	SF	V4XC-2012	V4XC-2024	V4XC-2032	V4SC-2096	V4SC-2960
Vero	92%	80–95%	SF	V4XC-2012	V4XC-2024	V4XC-2032	V4SC-2096	V4SC-2960

For a complete list of Optimized Protocols for cell lines, please refer to [www.lonza.com/protocols](http://www.lonza.com/protocols) or contact Scientific Support

## Cell Line Kits for 4D-Nucleofector™ LV Unit

For large scale-transfection using the new 4D-Nucleofector™ LV Unit we offer two different Nucleocuvette™ Cartridge formats: a fixed volume cartridge for 1 mL and a flow-through cartridge for up to 20 mL.

Experimental conditions that were established in smaller scale on the 4D-Nucleofector™ X Unit can be transferred onto these larger scale formats without re-optimization. For cell-type specific protocols and further guidelines, please contact Lonza Scientific Support.

Of the three cell line solutions [SE, SF, SG] only SF is available for the large-scale formats so far, which is suited for most cell lines used in transient protein production (e.g. suspension CHO or HEK293). Other solutions are available on request.

### Each kit contains

- Specific Nucleofector™ Solution
- Supplement
- pmaxGFP™ Control Vector
- Either 1mL Nucleocuvette™ Cartridge or LV Nucleocuvette™ Cartridge with tubing and 2 reservoirs


### Applications – 1 mL Nucleocuvette™ Cartridge

- 1 mL filling volume
- For transfection of up to  $1 \times 10^8$  cells
- Manual filling via sterile injection port

### Applications – LV Nucleocuvette™ Cartridge

- Up to 20 mL processing volume (in 1 mL steps)
- For scalable transfection of  $1 \times 10^8$  to  $1 \times 10^9$  cells
- Automatic filling via reservoirs or bags
- Allows for separate feeding of mRNA to avoid degradation

For quality information or additional options, please contact Lonza Scientific Support.

 [www.lonza.com/lv-unit](http://www.lonza.com/lv-unit)

### Ordering Information – Kits

Cat. No. NA	Cat. No. EU	Product Name	Product Description	Size
<b>4D-Nucleofector™ Kits</b>				
V4LC-2002	V4LC-2002	SF Cell Line 4D-Nucleofector™ LV Kit L	1 mL Nucleocuvette™ Cartridge	2 reactions
V4LC-2020	V4LC-2020	SF Cell Line 4D-Nucleofector™ LV Kit XL	LV Nucleocuvette™ Cartridge	1 reaction
V4LC-2520	V4LC-2520	SF Cell Line 4D-Nucleofector™ LV Kit XL	LV Nucleocuvette™ Cartridge	5 × 1 reaction
<b>Accessories</b>				
V4LR-1001	V4LR-1001	4D-Nucleofector™ LV Reservoir		2 pieces



1 mL Nucleocuvette™ Cartridge



LV Nucleocuvette™ Cartridge with tubing



4D-Nucleofector™ LV Reservoirs

## Cell Line Optimization Kits for 4D Nucleofector™ X Unit, 96-well Shuttle™ and 384-well Nucleofector™ Systems

The Cell Line Optimization Nucleofector™ Kits are the ideal tool to conveniently and rapidly determine the optimal Nucleofection Condition of virtually any difficult-to-transfect cell line within one experiment.




With the unique capability of the different Nucleofector™ Platforms (4D-Nucleofector™ System, 96-well Shuttle™ System or 384-well Nucleofector™ System) to address individual wells of a 16-well, 96-well or 384-well Nucleocuvette™ Plate with different programs, cell line optimizations are easily performed within one experiment. In each system our three Cell Line Nucleofector™ Solutions SE, SF and SG are tested with a pre-selected set of programs plus controls.

### ■ Benefits

- Optimal Nucleofection Conditions determined on one platform are transferable to the others and also to the 100 µL single Nucleocuvette™ on the 4D-Nucleofector X Unit

### ■ Application

- Convenient and rapid determination of optimal Nucleofection Conditions for virtually any difficult-to-transfect cell line within 1 experiment

Platform	4D-Nucleofector™ System	96-well Shuttle™ System	384-well Nucleofector™ System
			
Kit contents	<ul style="list-style-type: none"> <li>- Four 16-well Nucleocuvette™ Strips</li> <li>- Specific Nucleofector™ Solution</li> <li>- Supplement</li> <li>- pmaxGFP™ Control Vector</li> </ul>	<ul style="list-style-type: none"> <li>- One 96-well Nucleocuvette™ Plate</li> <li>- Specific Nucleofector™ Solution</li> <li>- Supplement</li> <li>- pmaxGFP™ Control Vector</li> </ul>	<ul style="list-style-type: none"> <li>- One 384-well Nucleocuvette™ Plate</li> <li>- Specific Nucleofector™ Solution</li> <li>- Supplement</li> <li>- pmaxGFP™ Control Vector</li> </ul>
Number of optimization reactions	48 rxn (plus 16 rxn for optional fine tuning)	96 rxn	384 rxn

### Ordering Information – Kits

Cat. No. NA	Cat. No. EU	Product Name	Product Description	Size
<a href="#">Cell Line Kits for 4D-Nucleofector™, 96-well Shuttle™ and 384-well Nucleofector™ Systems</a>				
V4XC-9064	V4XC-9064	Cell Line Optimization 4D-Nucleofector™ X Kit	20 µL Nucleocuvette™ Strip	64 reactions (16-well)
<a href="#">Cell Line Kits for 4D-Nucleofector™, 96-well Shuttle™ and 384-well Nucleofector™ Systems</a>				
V4SC-9096	V4SC-9096	Cell Line Optimization 96-well Nucleofector™ Kit	20 µL Nucleocuvette™ Plate	96 reactions (96-well)
<a href="#">Cell Line Kits for 4D-Nucleofector™, 96-well Shuttle™ and 384-well Nucleofector™ Systems</a>				
V5SC-9001	V5SC-9001	Cell Line Optimization 384-well Nucleofector™ Kit	20 µL Nucleocuvette™ Plate	384 reactions (384-well)

## Cell Line Kits for Nucleofector™ II/2b Device

For the transfection of cell lines with the Nucleofector™ II/2b Device, we offer five different Cell Line Nucleofector™ Solutions: C, L, R, T, and V. Optimized Protocols outlining the optimal Nucleofector™ Kit for a large selection of cell lines are available and can be downloaded from our website.

### ■ Benefits

- Achieve transfection efficiencies of up to 90% with high cell viability

### ■ Applications

- Get up to 99% transfection efficiency with siRNA duplexes even in suspension cells
- Expression within hours – from transfection to analysis in a day



[www.lonza.com/celldatabase](http://www.lonza.com/celldatabase)

[www.lonza.com/protocols](http://www.lonza.com/protocols)

### Ordering Information – Kits

Cat. No. NA	Cat. No. EU	Product Name	Size
VACA-1004	VACA-1004	Cell Line Nucleofector™ Kit C	10 reactions
VCA-1004	VCA-1004	Cell Line Nucleofector™ Kit C	25 reactions
VVCA-1004	VVCA-1004	Cell Line Nucleofector™ Kit C	4 × 25 reactions
VACA-1005	VACA-1005	Cell Line Nucleofector™ Kit L	10 reactions
VCA-1005	VCA-1005	Cell Line Nucleofector™ Kit L	25 reactions
VVCA-1005	VVCA-1005	Cell Line Nucleofector™ Kit L	4 × 25 reactions
VACA-1001	VACA-1001	Cell Line Nucleofector™ Kit R	10 reactions
VCA-1001	VCA-1001	Cell Line Nucleofector™ Kit R	25 reactions
VVCA-1001	VVCA-1001	Cell Line Nucleofector™ Kit R	4 × 25 reactions
VACA-1002	VACA-1002	Cell Line Nucleofector™ Kit T	10 reactions
VCA-1002	VCA-1002	Cell Line Nucleofector™ Kit T	25 reactions
VVCA-1002	VVCA-1002	Cell Line Nucleofector™ Kit T	4 × 25 reactions
VACA-1003	VACA-1003	Cell Line Nucleofector™ Kit V	10 reactions
VCA-1003	VCA-1003	Cell Line Nucleofector™ Kit V	25 reactions
VVCA-1003	VVCA-1003	Cell Line Nucleofector™ Kit V	4 × 25 reactions

### Quick Reference Guide – Optimized Protocols for Nucleofector™ II/2b Device – Cell Lines

Cell line	Efficiency	Viable cells	Solution	10 rxn	25 rxn	100 rxn
293	84%		V	VACA-1003	VCA-1003	VVCA-1003
32D	79%	61%	V	VACA-1003	VCA-1003	VVCA-1003
3T3-L1 ad	25%	90%	L	VACA-1005	VCA-1005	VVCA-1005
3T3-L1 pre-ad	73%	59%	V	VACA-1003	VCA-1003	VVCA-1003
A-10	64%	74%	L	VACA-1005	VCA-1005	VVCA-1005
A-375	72%	97%	V	VACA-1003	VCA-1003	VVCA-1003
A-431	45%	83%	T	VACA-1002	VCA-1002	VVCA-1002
A20	37–74%	81–95%	V	VACA-1003	VCA-1003	VVCA-1003
A2058	81%	94%	C	VACA-1004	VCA-1004	VVCA-1004
A549	72%	81%	T	VACA-1002	VCA-1002	VVCA-1002
A7r5	49%	81%	V	VACA-1003	VCA-1003	VVCA-1003
AGS	73%	62%	V	VACA-1003	VCA-1003	VVCA-1003
ARPE-19	83%	92%	V	VACA-1003	VCA-1003	VVCA-1003



# Cell Line Kits for Nucleofector™ II/2b Device

Continued

## Quick Reference Guide – Optimized Protocols for Nucleofector™ II/2b Device – Cell Lines

Cell line	Efficiency	Viable cells	Solution	10 rxn	25 rxn	100 rxn
B16-F0	84%	91%	R	VACA-1001	VCA-1001	VVCA-1001
B16-F10	91%	96%	V	VACA-1003	VCA-1003	VVCA-1003
BA/F3	88%	79%	V	VACA-1003	VCA-1003	VVCA-1003
BHK-21	85%	78%	L	VACA-1005	VCA-1005	VVCA-1005
BJ	52%	76%	R	VACA-1001	VCA-1001	VVCA-1001
BxPC-3	28%	62%	L	VACA-1005	VCA-1005	VVCA-1005
C2C12	82%	93%	V	VACA-1003	VCA-1003	VVCA-1003
C6	94%	75–80%	V	VACA-1003	VCA-1003	VVCA-1003
Caco-2	59%	70%	T	VACA-1002	VCA-1002	VVCA-1002
Capan-1	29%	78%	V	VACA-1003	VCA-1003	VVCA-1003
CCRF-CEM	68%	79%	C	VACA-1004	VCA-1004	VVCA-1004
CHO (suspension)	92%	82%	V	VACA-1003	VCA-1003	VVCA-1003
CHO-K1	94%	53–87%	T	VACA-1002	VCA-1002	VVCA-1002
CHO-S (suspension)	90–98%	67–72%	V	VACA-1003	VCA-1003	VVCA-1003
COS-1	49%	64%	T	VACA-1002	VCA-1002	VVCA-1002
COS-7	99%	94%	R	VACA-1001	VCA-1001	VVCA-1001
D1 ORL UVA	61%	97%	T	VACA-1002	VCA-1002	VVCA-1002
DU 145	47%	89%	L	VACA-1005	VCA-1005	VVCA-1005
EL4	65%	76%	L	VACA-1005	VCA-1005	VVCA-1005
FDC-P1	82%	84%	L	VACA-1005	VCA-1005	VVCA-1005
GH3	77%	84%	L	VACA-1005	VCA-1005	VVCA-1005
H9c2(2-1)	86%	90%	L	VACA-1005	VCA-1005	VVCA-1005
HaCaT	43%		V	VACA-1003	VCA-1003	VVCA-1003
HCT 116	78%	76%	V	VACA-1003	VCA-1003	VVCA-1003
HeLa	70%		R	VACA-1001	VCA-1001	VVCA-1001
HeLa S3	67%	95%	L	VACA-1005	VCA-1005	VVCA-1005
Hep G2	41–64%	86–94%	V	VACA-1003	VCA-1003	VVCA-1003
HL-60	90%	50–65%	V	VACA-1003	VCA-1003	VVCA-1003
HT-1080	74%	76%	T	VACA-1002	VCA-1002	VVCA-1002
HT-29	16–51%	57–94%	R	VACA-1001	VCA-1001	VVCA-1001
HuT 78	53%	64%	R	VACA-1001	VCA-1001	VVCA-1001
HUV-EC-C	75%	77%	V	VACA-1003	VCA-1003	VVCA-1003
IMR-32	80%	62%	L	VACA-1005	VCA-1005	VVCA-1005
IMR-90	51%	70%	R	VACA-1001	VCA-1001	VVCA-1001
Jurkat	65–80%	74%	V	VACA-1003	VCA-1003	VVCA-1003
K-562	79%	89%	V	VACA-1003	VCA-1003	VVCA-1003
KG-1	70%	84%	R	VACA-1001	VCA-1001	VVCA-1001
KG-1a	86%	79%	L	VACA-1005	VCA-1005	VVCA-1005
L-428	78%	73%	L	VACA-1005	VCA-1005	VVCA-1005
L6	59%	92%	R	VACA-1001	VCA-1001	VVCA-1001
LNCaP	82%	70–80%	R	VACA-1001	VCA-1001	VVCA-1001
MCF7	77%	60%	V	VACA-1003	VCA-1003	VVCA-1003
MDA-MB-231	79%	77%	V	VACA-1003	VCA-1003	VVCA-1003
MDA-MB-453	54%	90%	C	VACA-1004	VCA-1004	VVCA-1004
MDA-MB-468	60%	81%	V	VACA-1003	VCA-1003	VVCA-1003
MDBK	59%	96%	R	VACA-1001	VCA-1001	VVCA-1001
MDCK	73%	83%	L	VACA-1005	VCA-1005	VVCA-1005
MDCK II	80%	88%	L	VACA-1005	VCA-1005	VVCA-1005

# Cell Line Nucleofector™ II/2b Kits

Continued

## Quick Reference Guide – Optimized Protocols for Nucleofector™ II/2b Device – Cell Lines

Cell line	Efficiency	Viable cells	Solution	10 rxn	25 rxn	100 rxn
MEG-01	80%	66%	C	VACA-1004	VCA-1004	VVCA-1004
MG-63	62%	90%	C	VACA-1004	VCA-1004	VVCA-1004
MOLT-4	55%	61%	L	VACA-1005	VCA-1005	VVCA-1005
MV-4-11	29%	79%	L	VACA-1005	VCA-1005	VVCA-1005
NALM-6	64%	87%	T	VACA-1002	VCA-1002	VVCA-1002
NB-4	71%	66%	V	VACA-1003	VCA-1003	VVCA-1003
NCI-H1299 (H1299)	99%	75%	C	VACA-1004	VCA-1004	VVCA-1004
NCTC clone 929	67%	91%	V	VACA-1003	VCA-1003	VVCA-1003
Neuro-2a (N2a)			V	VACA-1003	VCA-1003	VVCA-1003
NG108-15	64%	82%	V	VACA-1003	VCA-1003	VVCA-1003
NIH/3T3	84%	87–89%	R	VACA-1001	VCA-1001	VVCA-1001
NK-92	26%	40%	R	VACA-1001	VCA-1001	VVCA-1001
NRK	44%	91%	T	VACA-1002	VCA-1002	VVCA-1002
NS0	83%	54%	C	VACA-1004	VCA-1004	VVCA-1004
NTERA-2 cl.D1	90%	94%	L	VACA-1005	VCA-1005	VVCA-1005
P19	85%	80%	V	VACA-1003	VCA-1003	VVCA-1003
P815	62%	92%	T	VACA-1002	VCA-1002	VVCA-1002
PANC-1	68%	75%	R	VACA-1001	VCA-1001	VVCA-1001
PC-12	92%	81%	V	VACA-1003	VCA-1003	VVCA-1003
PC-3	88%	59–66%	V	VACA-1003	VCA-1003	VVCA-1003
Raji	84%	67–81%	V	VACA-1003	VCA-1003	VVCA-1003
Ramos	27%	72%	V	VACA-1003	VCA-1003	VVCA-1003
RAW 264.7	65%	74%	V	VACA-1003	VCA-1003	VVCA-1003
RBL-1	83%	67%	V	VACA-1003	VCA-1003	VVCA-1003
RBL-2H3	42%	93%	T	VACA-1002	VCA-1002	VVCA-1002
S49	81%	68–95%	V	VACA-1003	VCA-1003	VVCA-1003
Saos-2	82%	79%	V	VACA-1003	VCA-1003	VVCA-1003
Schneider's Drosophila Line 2	77%	64–70%	V	VACA-1003	VCA-1003	VVCA-1003
Sf9	82%	76–79%	R	VACA-1001	VCA-1001	VVCA-1001
SH-SY5Y	63–82%	40%	V	VACA-1003	VCA-1003	VVCA-1003
SK-BR-3	50%	94%	C	VACA-1004	VCA-1004	VVCA-1004
SK-N-SH	85%	73%	V	VACA-1003	VCA-1003	VVCA-1003
SK-OV-3	89%	53%	V	VACA-1003	VCA-1003	VVCA-1003
SW480	60%	86%	V	VACA-1003	VCA-1003	VVCA-1003
T-47D	51%	94%	V	VACA-1003	VCA-1003	VVCA-1003
T/C-28 a2	90%	80%	V	VACA-1003	VCA-1003	VVCA-1003
T/G HA-VSMC	58%	79%	V	VACA-1003	VCA-1003	VVCA-1003
T2	60%	68%	C	VACA-1004	VCA-1004	VVCA-1004
T84	53%	83%	T	VACA-1002	VCA-1002	VVCA-1002
TF-1	38%	82%	T	VACA-1002	VCA-1002	VVCA-1002
THP-1	47–68%	40–58%	V	VACA-1003	VCA-1003	VVCA-1003
U-2 OS	98%	88%	V	VACA-1003	VCA-1003	VVCA-1003
U-87 MG	43%	91%	T	VACA-1002	VCA-1002	VVCA-1002
U-937	20–30%		C	VACA-1004	VCA-1004	VVCA-1004
U266B1	86%	91%	V	VACA-1003	VCA-1003	VVCA-1003
Vero	79%	97%	V	VACA-1003	VCA-1003	VVCA-1003
WEHI-231	77%	62%	L	VACA-1005	VCA-1005	VVCA-1005
WI-38	75%	91%	R	VACA-1001	VCA-1001	VVCA-1001

6

Transfection / Nucleofector™ Kits for Cell Lines

## Cell Line Optimization Kit for Nucleofector™ II/2b Device



The Cell Line Optimization Nucleofector™ Kit is the ideal tool for the transfection of virtually any difficult-to-transfect cell line with the Nucleofector™ II/2b Device. It enables you to conveniently determine the optimal Nucleofection Condition of your cell line of interest within one experiment. The kit contains two different Cell Line Nucleofector™ Solutions, V and L, each of which should be tested in combination with seven different Nucleofector™ Programs. Fine-tuning for optimal results can then be performed together with our Scientific Support Team.

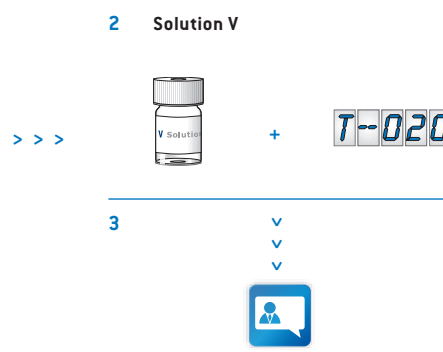
### ■ Benefits

- Efficient transfection of virtually any difficult-to-transfect cell line
- Simple and rapid optimization completed within just one experiment

### ■ Applications

- Transfection of virtually any difficult-to-transfect cell line with the Nucleofector™ II/2b Device

1 Solution	L	V
		
Program 1	A-020	A-020
Program 2	T-020	T-020
Program 3	T-030	T-030
Program 4	X-001	X-001
Program 5	X-005	X-005
Program 6	L-029	L-029
Program 7	D-023	D-023



### Step 1

The cell line of interest is transfected with the Nucleofector™ Solutions L and V in combination with seven different Nucleofector™ Programs.

### Step 2

The Nucleofector™ Solution and Program which result in highest transfection efficiencies with lowest mortality are selected.

### Step 3

A further fine tuning of the Nucleofection Conditions can be performed with the help of our Scientific Support Team.

### Ordering Information – Kits

Cat. No. NA	Cat. No. EU	Product Name	Product Description	Size
VCO-1001N	VCO-1001N	Cell Line Optimization Nucleofector™ Kit	100 µL aluminum cuvette	18 reactions

Related Products	Page
Classical Media	123-132

# Basic Parasite Nucleofector™ Kits

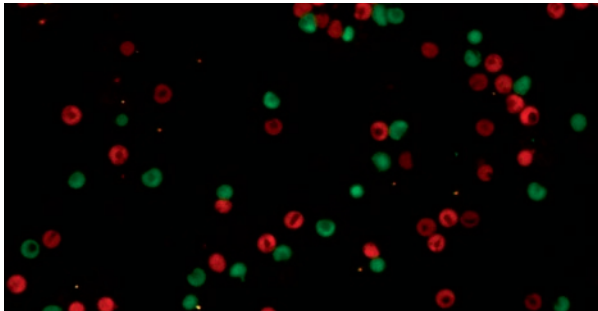
Parasitic protozoa infect vertebrates and invertebrates and some are even parasitic in plants. In humans, they can cause severe diseases, such as Malaria (*Plasmodium*), Sleeping Sickness (*Trypanosoma*) or *Leishmaniasis* (*Leishmania*). Nucleofection has proven to provide considerably higher transfection efficiencies (e.g., in *Plasmodium berghei* and *Trypanosoma brucei*) compared to standard methods, such as electroporation or particle bombardment. Due to significant genotypic and phenotypic diversity between species and life cycles, we have developed two Basic Parasite Nucleofector™ Kits (1 and 2) and an easy-to-use Basic Parasite Nucleofector™ Starter Kit.

■ **Benefits**

- Increased transfection efficiencies compared to standard methods, such as electroporation or particle bombardment

■ **Applications**

- Proven results for *Plasmodium berghei* and *Trypanosoma brucei*

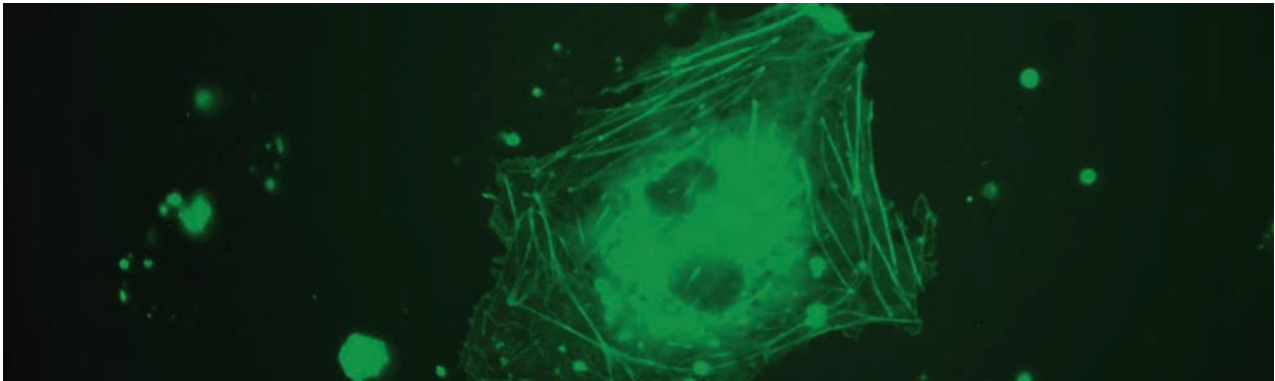


**Nucleofection of the rodent malaria parasite *Plasmodium berghei*.** *Plasmodium berghei* parasites were transfected with a reporter vector containing two genes encoding for green fluorescent protein (GFP) and red fluorescent protein (RFP) under control of sex-specific promoters. After selection of transgenic parasites, sexual cells (gametocytes) of these parasites were analyzed by fluorescence microscopy. Male cells showed green and female cells a red fluorescence. (Data kindly provided by Chris Janse, Blandine Franke-Fayard and Andrew Waters, Leiden Malaria Research Group, Department of Parasitology, Leiden University Medical Centre, Netherlands.)

## Ordering Information – Kits

Cat. No. NA	Cat. No. EU	Product Name	Product Description	Size
VMI-1001	VMI-1001	Basic Parasite Starter Nucleofector™ Kit	100 µL aluminum cuvette	10 reactions
VAMI-1011	VAMI-1011	Basic Parasite Nucleofector™ Kit 1	100 µL aluminum cuvette	10 reactions
VMI-1011	VMI-1011	Basic Parasite Nucleofector™ Kit 1	100 µL aluminum cuvette	25 reactions
VVMI-1011	VVMI-1011	Basic Parasite Nucleofector™ Kit 1	100 µL aluminum cuvette	4 × 25 reactions
VAMI-1021	VAMI-1021	Basic Parasite Nucleofector™ Kit 2	100 µL aluminum cuvette	10 reactions
VMI-1021	VMI-1021	Basic Parasite Nucleofector™ Kit 2	100 µL aluminum cuvette	25 reactions
VVMI-1021	VVMI-1021	Basic Parasite Nucleofector™ Kit 2	100 µL aluminum cuvette	4 × 25 reactions

# Nucleofector™ Kit Accessories



## Nucleofector™ Kit Accessories

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Mouse T Cell Nucleofector™ Medium	262
pmaxCloning™ Vector	262

## Introduction

We offer a range of accessory products that can be used in combination with our Nucleofector™ Technology.

- **Mouse T Cell Nucleofector™ Medium** – For optimal Nucleofection Performance with mouse T cells
- **pmaxCloning™ Vector** – For cloning your gene of interest into a high expression level plasmid

## Mouse T Cell Nucleofector™ Medium

For optimal Nucleofection Performance with mouse T cells it is highly recommended to use Mouse T Cell Nucleofector™ Medium for cell culture steps post Nucleofection.

The medium is included in our Mouse T Cell Nucleofector™ Kit (for the Nucleofector™ II/2b Device), and offered as separate product when using the P3 Kit with the 4D-Nucleofector™ System or the 96-well Shuttle™ Device.

### ■ Benefits

- Provides consistent, high-yield Nucleofection Results
- Essential for survival of transfected mouse T cells

### ■ Applications

- For use in combination with the P3 Primary Cell 4D-Nucleofector™ or 96-well Nucleofector™ Kits
- For post Nucleofection Culture of mouse T cells

### Ordering Information – Medium

Cat. No. NA	Cat. No. EU	Product Name	Size	Storage Conditions
VZB-1001	VZB-1001	Mouse T Cell Nucleofector™ Medium	100 mL	4° to 8°C, do not freeze

### Related Products

Related Products	Page
Mouse T Cell Nucleofector™ Kits	215

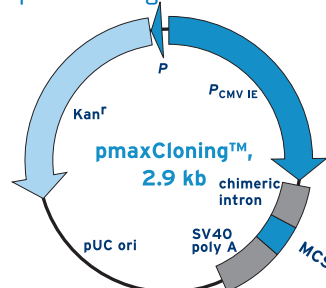
## pmaxCloning™ Vector

### ■ Benefits:

- High expression rate in mammalian cells
- License-free use for research purposes
- Multiple cloning site for convenient insertion of the gene-of-interest

**NOTE:** The CMV promoter is covered under U.S. patent 5,385,839 and its use is permitted for research purposes only. Any other use of the CMV promoter requires a license from the University of Iowa Research Foundation, 214 Technology Innovation Center, Iowa City, IA.

### pmaxCloning™ Vector



### MCS

Kpn I	Pst I
Pme I	BamH I
Hind III	Xho I
EcoR I	Nhe I
Xba I	Not I
EcoR V	Pme I
	Sac I

### Ordering Information – Kits

Cat. No. NA	Cat. No. EU	Product Name	Product Description	Size
VDC-1040	VDC-1040	pmaxCloning™ Vector	Concentration: 0.5 µg/µL	20 µg