ESBE Scientific

Lonza

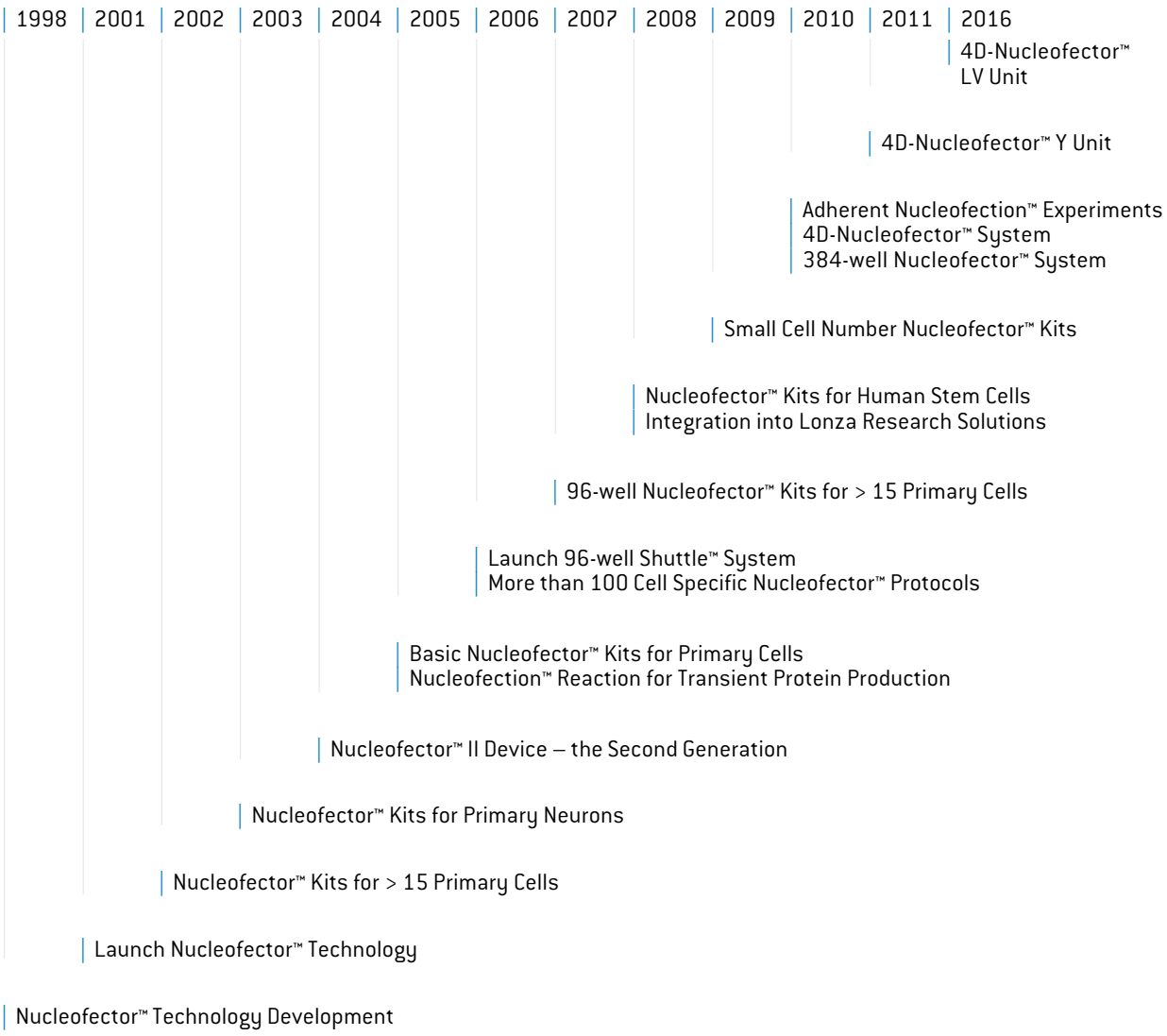
Pharma & Biotech

Stretching transfection dimensions

Nucleofector™ Technology

Contents

History of constant innovation



Introduction: Nucleofector™ Technology

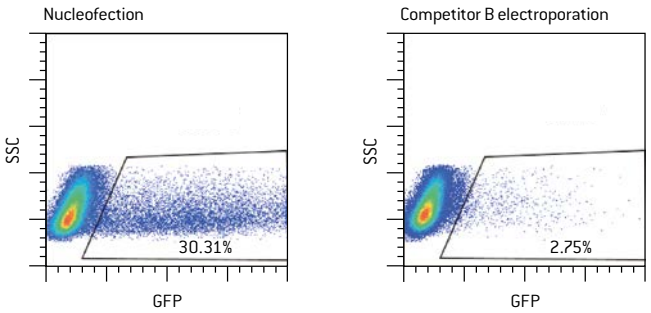
The application of systems biology and multidisciplinary approaches require that cells and model systems display *in vivo* like cellular functionality. This means that the future of cell transfection is in using primary cell types, and that transfecting these physiologically relevant cell types is typically 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 (see history).

The principle

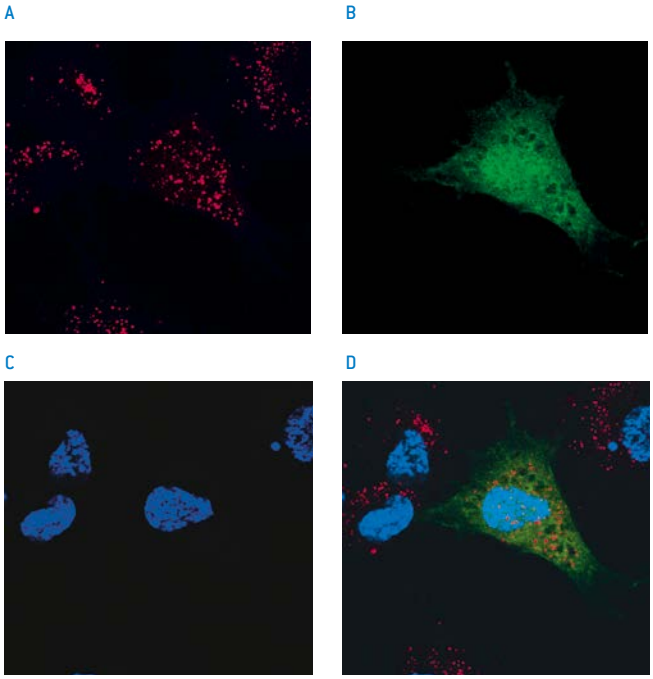
Nucleofection™ is a technology based on the momentary creation of small pores in cell membranes by applying an electrical pulse. The comprehensive way in which Nucleofector™ Programs and cell type-specific solutions are developed enables nucleic acid substrates delivery not only to the cytoplasm, but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

Nucleofector™ Technology – the superior non-viral method



Transfection of the human natural killer cell line NKL using traditional electroporation and Nucleofection™ Experiment. 5 x 106 NKL cells were transfected with 2.5 µg of pmaxGFP™ Vector. Nucleofection™ Experiment: Nucleofector™ Solution V; Program O-017. Competitor B electroporation: 25 mV, 96 µF. Transfection efficiency was monitored by flow cytometry after 24 hours. Cells transfected by a Nucleofection™ Experiment shows 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™ Reaction.
(Data courtesy of Dr. John Coligan, Laboratory of Immunogenetics, NIH/NIAID, Rockville, MD, USA. J Immunol Methods (2004) 284: 133-140.)

DNA delivery straight into the nucleus (Nucleofector™ Technology)



Normal human dermal fibroblasts (neonatal) were transfected with 2.5 µg TMR-labeled plasmid DNA encoding eGFP. After 2 hours, cells were fixed with 3.5% PFA and analyzed by confocal micros copy. TMR label is shown in (A), GFP fluorescence in (B), DAPI nuclear staining in (C) and a merge of all three fluorescent labels in (D).

What benefits are important for your work?

Looking for superior transfection performance?

- Electrical parameters are optimized to gain high transfection efficiency and retain high 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

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

Relying on a 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™ Reaction of cells in adherence

Using various cell numbers for different applications?

- Nucleofection™ Reaction of 2 x 10^4 to 1 x 10^9 depending one device
- Transferability of protocol conditions from small to larger cell numbers with the 4D-Nucleofector™ System

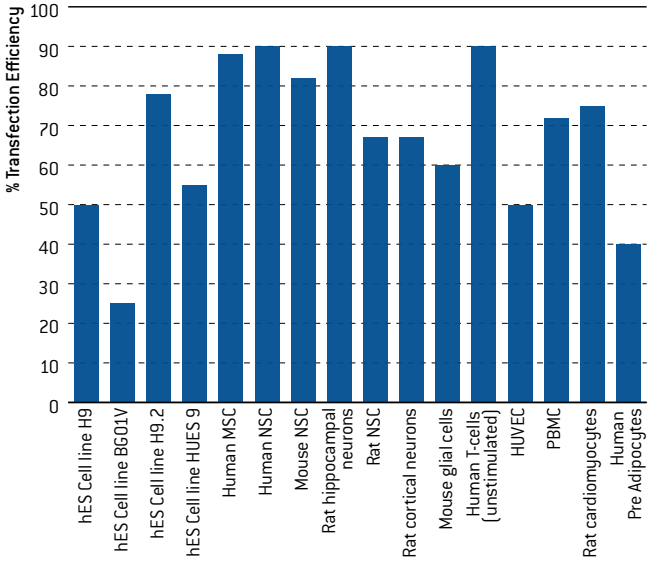
Stretching the dimensions of your research?

- 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?

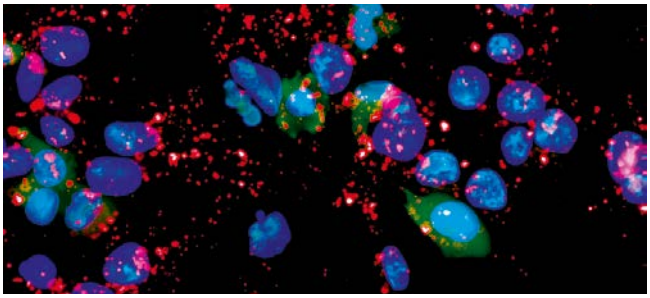
- Disposable, sterile Nucleofection™ Vessels minimize the risk of cross-contamination with cell or substrate leftovers

Average transfection effciency for primary cells and human stem cells



Overview about transfection efficiencies achieved by Nucleofection™ Experiments for various primary cells and stem cells.

Conserving functionality – the first step to meaningful analysis



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

The 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 three different device platforms plus an add-on device (see table below)

- 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)	2×10^4 to 1×10^6 (20 µL)	2×10^4 to 1×10^6	2×10^4 to 1×10^6	–
Medium cell numbers (X Unit)	2×10^5 to 2×10^7 (100 µL)	–	–	2×10^5 to 2×10^7
High cell numbers (LV Unit)	$1x10^7$ to $1x10^8$ (1 mL) $1x10^8$ to $1x10^9$ (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™ Experiments	■	–	–	–
Compatibility with 96-well Shuttle™ Device	■	–	–	–

The advanced platform: 4D-Nucleofector™ System offering multi-dimensional flexibility

Based on numerous user feedback, Lonza engineers and scientists have developed the innovative 4D-Nucleofector™ System. This system is designed for maximum flexibility and enables Nucleofection™ Experiments 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 pre-definition of experiments on a PC which can then be uploaded to the 4D-Nucleofector™ Core Unit via the integrated USB port.

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 µL Nucleocuvette™ Strip for low cell numbers down to 2×10^4
- 100 µL Nucleocuvette™ Vessels for high cell numbers up to 2×10^7
- 1 mL or LV Nucleocuvette™ Cartridges for large cell numbers up to 1×10^9

Working with various throughputs?

- Flexible throughput from 1 to 16 samples
- Pre-programming of settings for up to 50 single 100 µL Nucleocuvette™ Vessels or one 20 µL Nucleocuvette™ Strip
- Kit costs tailored to your throughput

Transfecting different primary cell types?

- Five primary cell kits covering a broad range of primary cells
- Primary Cell Optimization Kit for cells lacking an Optimized Protocol
- Easy optimization of a variety of cell lines using the 96-well Shuttle™ Add-on Device

Preserving cell functionality?

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

1 **Core Unit – Controlling the 4D-Nucleofector™ System**
- Intuitive operation software for designing and saving experiments
- Predefined Nucleofection™ Parameters and experiments
- PC editor for predefinition of experiments
- 5.7" foldable touch screen to operate the system
- Controls up to 5 functional units
- USB port for software update and data transfer
- Comprises USB and serial connectivity for the 96-well Shuttle™ Device

2 **X Unit – Supporting Nucleofection™ Experiments of various cell numbers in different formats**
- Features positions for 20 µL Nucleocuvette™ Strips and 100 µL single Nucleocuvette™ Vessels
- Comprises HV connectivity for the 96-well Shuttle™ Device

3 **Y Unit – Enabling Adherent Nucleofection™ Experiments in 24-well culture plates**
- Features position for one 24-well Dipping Electrode Array

New **LV Unit – For large-scale transfection of up to 1×10^9 cells**
- Suited for 1 mL Nucleocuvette™ Cartridges (fixed volume) or LV Nucleocuvette™ Cartridges (flexible volume up to 20 mL)

The most flexible unit: 4D-Nucleofector™ X Unit

Different vessels for flexible cell numbers

The X Unit of the 4D-Nucleofector™ System can handle two different Nucleocuvette™ Vessels both composed out of the same conductive polymer electrode material:

Single 100 µL Nucleocuvette™ Vessels:

- Novel conductive polymer 100 µL cuvettes replacing former aluminum cuvettes
- For high cell numbers at low throughput (e.g. for biochemical applications or Western Blots)

16-well 20 µL Nucleocuvette™ Strips

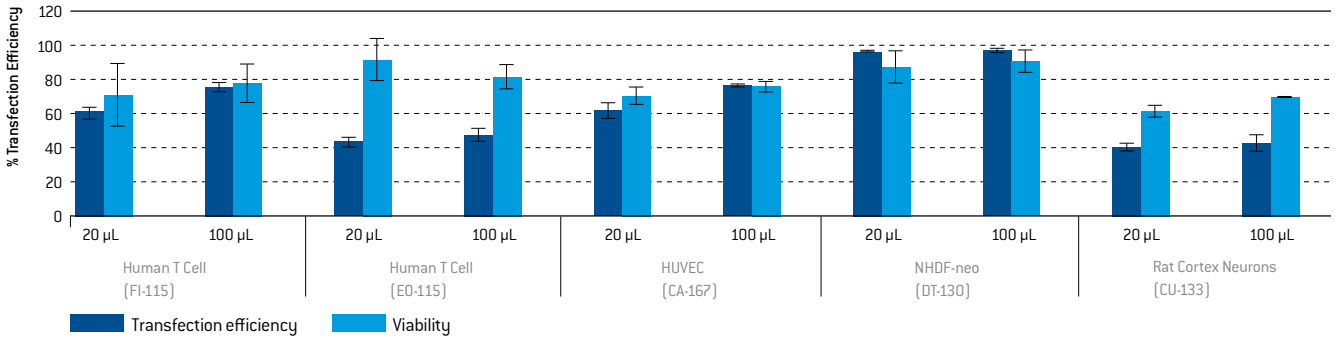
- Same strips as those assembled to a 96-well Nucleocuvette™ Plate
- For low cell numbers at medium throughput (e.g. reporter gene assays, RNAi

Same conditions for different cells numbers

As the same electrode material is now used for 20 and 100 µL cuvettes, Nucleofection™ Conditions are transferable between the different Nucleocuvette™ vessels offering maximum flexibility and convenience:

- Once the conditions are known for one format they can be easily transferred to the other format.
- Conditions are transferable between different throughput formats (4D-Nucleofector™ System, 96-well Shuttle™ Device and 384-well Nucleofector™ System).
- Existing 96-well Shuttle™ Protocols can be used with the 4D-Nucleofector™ System.

Transferability between Nucleofection™ Conditions between different formats



Various primary cells were transfected in the two Nucleocuvette™ vessel formats (20 µL and 100 µL) using the indicated programs. Twenty-four hours post Nucleofection™ Experiments cells were analyzed for transfection efficiency (flow cytometry) and viability (cell number normalized to no program control).

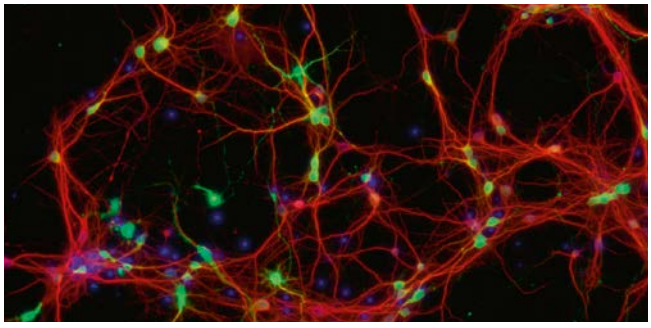
The adherent Nucleofection™ Module: 4D-Nucleofector™ Y Unit

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™ Reaction of cells in adherence. Cells which typically grow in adherence in cell culture, can be kept and transfected by Nucleofection™ Reaction in their physiological state.

The **4D-Nucleofector™ Y Unit** works with disposable conductive polymer dipping electrode arrays that can be inserted into standard 24-well culture plates for the Nucleofection™ Experiments.

Benefits

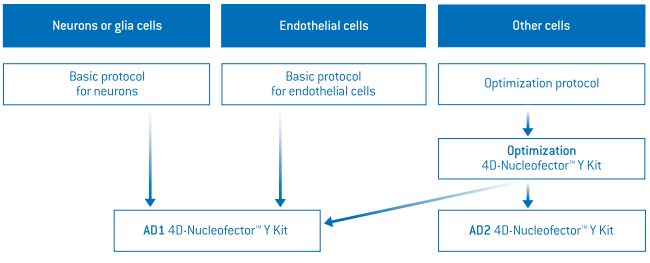
- Pre- and post Nucleofection™ Culture in 24-well culture plates
- Nucleofection™ Experiments of cells at any time point during this culture period, *i.e.* at a later developmental stage
- Transfection efficiencies up to 70% combined with high viabilities
- Compatible with Clonetics™ primary animal neurons

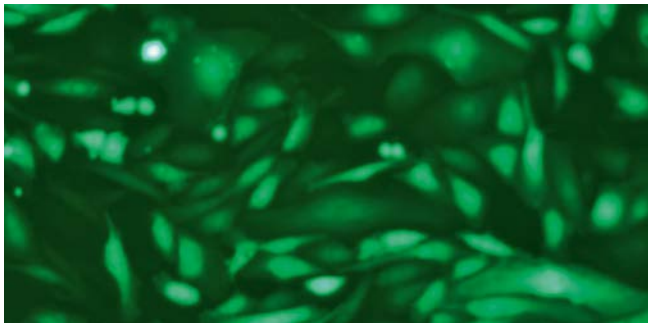


Efficient adherent Nucleofection™ Reaction of neurons in 24-well culture plates. Mouse cortical neurons were seeded into poly-D-lysine coated 24-well plates (1 x 10^5 cells/well). After 6 DIV, cells were transfected with pmaxGFP™ Vector using the AD1 4D-Nucleofector™ Y Kit. One day post Nucleofection™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

Consumables

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 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 following guideline:





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)

www.lonza.com/adherent-Nucleofection

The large-scale format: 4D-Nucleofector™ 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 $1x10^7$ to $1x10^9$ 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.

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

Benefits

- **Closed system** – Sterile Nucleofection™ Procedure 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

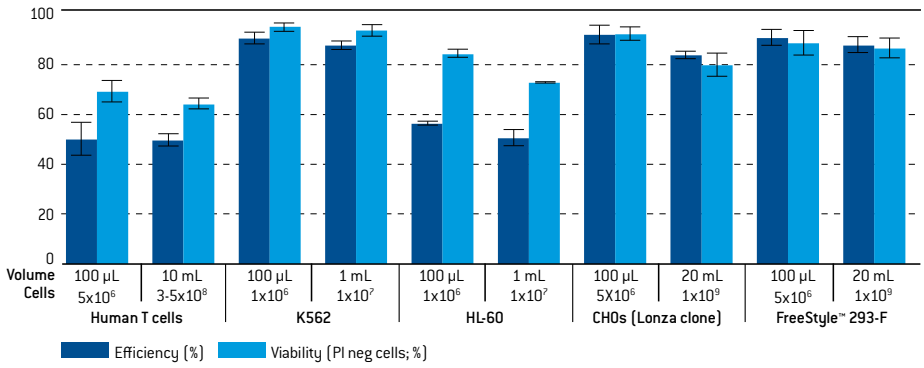
A

B

Two formats available. (A) **1 mL Nucleocuvette™ Cartridge:** 1 mL filling volume for up to 1 x 10^8 cells (manual filling via steriale injection port) (B) **LV Nucleocuvette™ Catridge:** Up to 20 mL processing volume (in 1 mL steps) for up to 1 x 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™ Logware

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

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 screen

The add-on: 96-well Shuttle™ Device

The 96-well Shuttle™ Device delivers flexible throughput combined with economical processing, speed, and pre-optimized protocols for a range of both primary cells and cell lines. It is a medium throughput extension to the 4D-Nucleofector™ Device suited for convenient optimization of Nucleofection™ Conditions or as assay establishment tool. The complete system consists of three components:

- The **4D-Nucleofector™ Device (Core and X Unit)** serving as the program delivery unit
- The **96-well Shuttle™ Device** as contacting unit 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

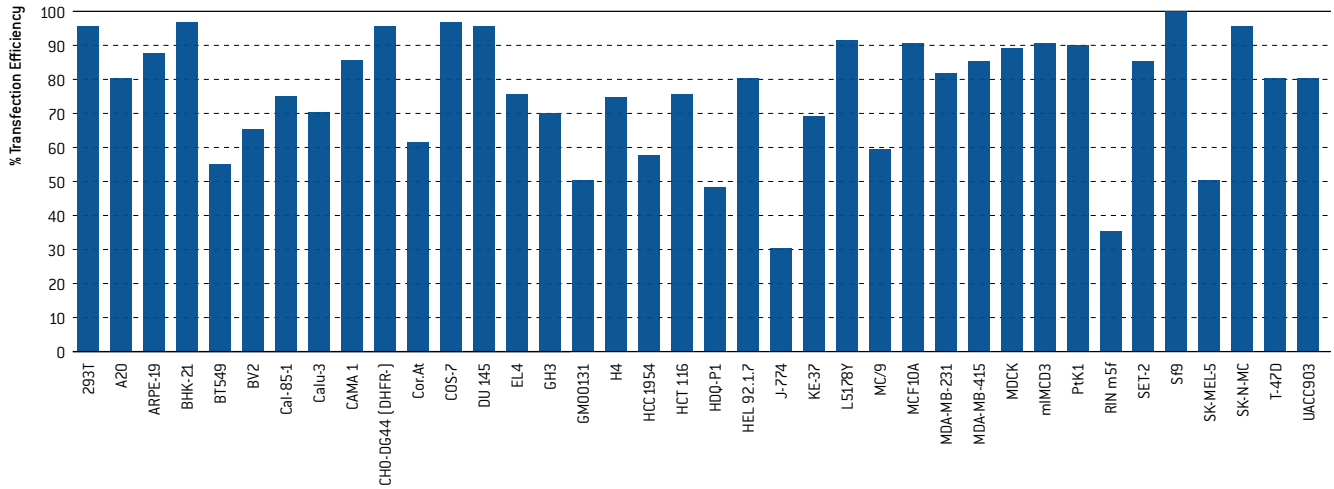
Consumables

- P1 – P5 96-well Nucleofector™ Kits for transfection primary cells
- SE, SF and SG 96-well Nucleofector™ Kits for transfection cell lines
- Optimization kits for primary cells and cell lines

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 prerequisites for liquid handling integration
- Optimization of any difficult-to-transfect cell line in just 1 plate
- Variable cell numbers from 10^4 – 10^6 cells per reaction

Optimization of Nucleofection™ Conditions within just one experiment



Examples of cell lines that have been optimized by customers using the Cell Line Optimization 96-well Nucleofector™ Kit.

The high-throughput platform: 384-well Nucleofector™ System

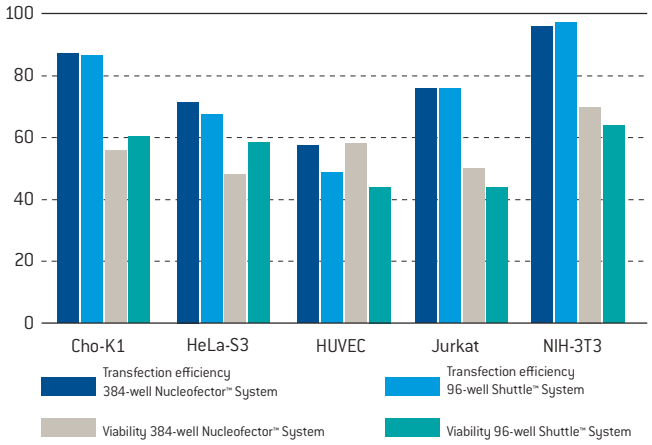
The 384-well Nucleofector™ System is an independent platform for high-throughput Nucleofection™ Experiments in 384-well format. With an extremely fast plate processing time of one minute and high reproduciblity it is the ideal tool for screening applications. Furthermore cell storage time in Nucleofector™ Solution is reduced to a minimum and all existing 96-well Shuttle™ Protocols can be used without further optimization.

The 384-well Nucleofector™ System consists of three components:

- A **Power Supply** Unit generating the high voltage pulses.
- The **Plate Handler** Unit with an electrically driven carousel that comprises two plate positions.
- An intuitive **PC-based Operation Software** which allows easy parameterization of HT Nucleofection™ Experiments and can be seamlessly integrated into market leading liquid handling systems.

Consumables

The 384-well Nucleofector™ Kits use existing 96-well Shuttle™ Protocols but contain specific conductive polymer 384-well Nucleocuvette™ Plates. The plates fulfill SBS standards to allow handling by automated liquid handling systems. Each of the 384-wells is individually addressable. Due to the use of conductive polymer cuvettes there is no contamination of cell suspension with metal ions.



Same conditions used for the 96-well Shuttle™ System and the 384-well Nucleofector™ System. The 384-well Nucleofector™ System works with 96-well Shuttle™ Parameters, thus the full spectrum of already optimized protocols is available for the 384-well Nucleofector™ System.

Benefits

Does speed count for your screens?

- Processes a 384-well plate in one minute
- Carousel handling two plates

Combining high performance with minimum material consumption?

- Nucleofection™ Reactions of low cell numbers down to $2x10^4$ cells

Easy-to-use and automatable system?

- Uses existing 4D-Nucleofector™ Protocols
- Operated by intuitive PC-software
- Seamless integration into automated liquid handling environments

The basic device: 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.

Consumables

- More than 50 dedicated primary cell kits, e.g. for blood cells or stem cells
- A collection of 5 cell line kits and an optimization kit covering a broad range of cell lines

Benefits

Highly efficient transfection in single cuvette format?

- Up to 90% efficiency with plasmid DNA
- Up to 99% efficiency with siRNA duplexes
- Also suited for peptides, proteins or small molecules

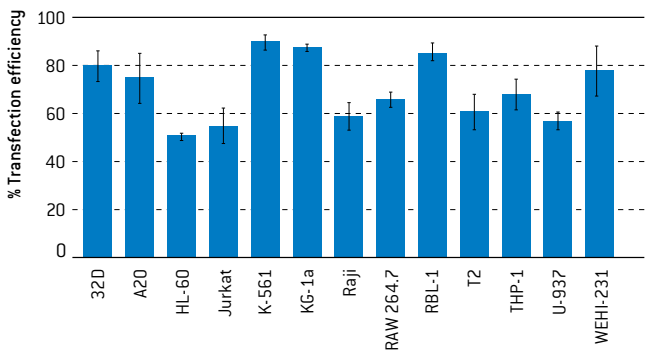
Easy-to-use technology with reliable results?

- More than 150 ready-to-use Optimized Protocols contain cell type-specific guidance
- Lonza's Cell Database contains user-developed protocols and data for more than 650 cell types
- Reliable and reproducible results due to high viability and preservation of cell functionality
- Approaching 4000 peer-reviewed publications

Consumables tailored to your needs?

- Nucleofector™ Kits are available in low, normal and high usage format, reducing the waste of precious consumables and offer flexible pricing for different transfection throughputs

High transfection efficiencies in suspension cell lines



Transfection efficiencies 24 hours post Nucleofection™ Experiments in selected cell lines relevant for immunology research. Cells were transfected with either eGFP, maxGFP™ Reporter Protein or H-2KK and analyzed 24 hours post Nucleofection™ Experiment. Viability ranged from 60 – 90%.

Nucleofector™ Kits tailored to your needs

Kits for 4D-Nucleofector™, 96-well Shuttle™ and 384-well Nucleofector™ Systems

As Nucleofection™ Vessels for the 4D-Nucleofector™, 96-well Shuttle™ and 384-well Nucleofector™ Systems utilize the same conductive polymer electrode material, Nucleofection™ Conditions are transferable between the different vessels or platforms offering maximum flexibility and convenience.

Nucleofector™ Kits for primary cells – high convenience due to simplified concept

With our conductive polymer cuvette concept, which was first established for the 96-well Shuttle™ System and now transferred to any new platform, we were able to streamline our kit concept for primary cells. The number of required Nucleofector™ Solutions for primary cells is narrowed down to only 5 solutions which makes Nucleofection™ Experiments of several different primary cell types much more convenient.

- A total of 5 dedicated primary cell Nucleofector™ Kits P1 – P5, each suited for several primary cell types
- Primary cell optimization Nucleofector™ Kits of primary cells lacking an optimized protocol

Nucleofector™ Kits for Cell Lines

For transfection of cell lines using the 4D-Nucleofector™, 96-well Shuttle™ or 384-well Nucleofector™ Systems

- Selection of 3 cell line Nucleofector™ Kits SE, SF and SG
- Cell line optimization Nucleofector™ Kits for cell lines lacking an optimized protocol

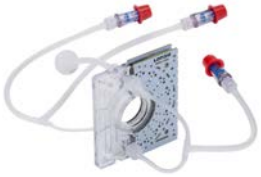
	100 µL Nucleocuvette™	16-well Nucleocuvette™ Strip	1 mL Nucleocuvette™ Cartridge	LV Nucleocuvette™ Cartridge
	4D-Nucleofector™ X Unit	4D-Nucleofector™ X Unit	4D-Nucleofector™ LV Unit	4D-Nucleofector™ LV Unit
				
Application	high cell numbers at low throughput e.g. for biochemical applications or Western Blots	low cell numbers at medium throughput e.g. reporter gene assays, RNAi	larger cells numbers, e.g. transient protein production, cell-based assays or establishing cell therapies	larger cells numbers, e.g. transient protein production, cell-based assays or establishing cell therapies
Cells/sample	2 x 10^5 to 2 x 10^7 cells	2 x 10^4 to 1 x 10^6 cells	2x10^7 – 1x10^8 cells	1x10^8 ™ 1x10^9 cells
Reaction volume	100 µL	20 µL	1 mL	up to 20 mL
Size(s) available	12 or 24 reactions	32 reactions	2 reactions	1 to 5 reactions

Table 1 – Kits types and sizes for the 4D-Nucleofector™ X and LV Unit.

4D-Nucleofector™ Kits for Adherent Nucleofection™ Experiments

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

Nucleofector™ Kits for Primary Cells

- Two 4D-Nucleofector™ Y Kits (AD 1 and AD2) that may serve different cell types
- An Optimization 4D-Nucleofector™ Y Kit for primary cells or cell lines lacking an Optimized Protocol

Note: Kits may also be used for cell lines

In addition to the specific Nucleofector™ Solution, Supplement, pmaxGFP™ Control Vector, each kit contains a 24-well Dipping Electrode Array and a Nunclon™ Δ Surface 24-well plate (Nunc).

Kits for Nucleofector™ II/2b Device

Nucleofector™ Kits for Primary Cells

The Nucleofector™ II/2b uses cell type specific kits, each of them dedicated to an individual primary cell.

- Individually developed Nucleofector™ Kits for more than 35 primary cell types

Nucleofector™ Kits for Cell Lines

- 5 different Cell line Nucleofector™ Kits C, L, R, T, and V
- Optimized Protocols outlining the optimal Nucleofector™ Kit for a large selection of cell lines can be downloaded from our website
- Cell line optimization Nucleofector™ Kit for cell lines lacking an Optimized Protocol

To find out which kit is the optimal one for your cell type of interest please check out our cell database for most up-to-date information **www.lonza.com/celldatabase**

	Dipping Electrode Array	96-well Nucleocuvette™ Plate	384-well Nucleocuvette™ Plate	Aluminum Cuvettes
	4D-Nucleofector™ Y Unit	96-well Shuttle™ Device	384-well Nucleofector™ System	Nucleofector™ II/2b Device
				
Application	analysis by confocal microscopy high cell numbers	low cell numbers at higher throughput *e.g.* reporter gene assays, RNAi, optimization	low cell numbers at high throughput e.g. screening	high cell numbers at low throughput e.g. for biochemical applications or Western Blots
Cells/sample	0.5 – 3 x 10^5 cells	2 x 10^4 to 1 x 10^6 cells	2 x 10^4 to 1 x 10^6 cells	2 x 10^5 to 2 x 10^7 cells
Reaction volume	350 µL	20 µL	20 µL	100 µL
Size(s) available	24 reactions	96 or 960 reactions	768 or 3840 reactions	10, 25, or 100 reactions

ESBE Scientific

SERVICING THE CANADIAN SCIENTIFIC COMMUNITY SINCE 1968

CANADIAN-OWNED PROVIDER OF LABORATORY EQUIPMENT & SUPPLIES.

COMPREHENSIVE PRODUCT PORTFOLIO

Access to over 100,000 laboratory products from more than 350 domestic and international suppliers

- Quality products at competitive prices

FULL SUITE OF IN-HOUSE AND ON-SITE SERVICES

Access to technical specialists and industry experts

Premier customer service available in English and French

- Licensed and ISO certified service provider

FEMALE-OWNED AND MANAGED

Diverse workforce across the Canadian landscape

2nd generation family-owned and operated for over 50 years

Get in touch with your local ESBE representative for more information on our products, promotions and pricing.

We provide top quality products for all types of scientific laboratories

www

esbe.com

Distributed by

ESBE Scientific

Get in touch with your local ESBE representative for more information on our products, promotions and pricing.

HEAD OFFICE:

ESBE Scientific
80 McPherson Street
Markham, Ontario L3R 3V6

Tel: 905-475-8232
Toll-free: 800-268-3477

QUEBEC OFFICE:

ESBE Scientifique
5657 chemin St-François
St-Laurent, Quebec H4S 1W6

Tel: 514-335-3421
Toll-free: 800-542-4818

esbe.com