BioResearch

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Amaxa™ 4D-Nucleofector™ Basic Protocol for Primary Mammalian Epithelial Cells

For 4D-Nucleofector™ X Unit—Transfection in suspension

Epithelial cells, adherent

Note

Mammalian epithelial cells display significant phenotypic variations due to the wide range of both species and body sites from which they may be sourced.

This basic protocol describes how to easily define optimal Nucleofection™ Conditions for different mammalian epithelial cells. We recommend to first test a set of pre-selected Nucleofector™ Programs together with two of our Primary Cell 4D-Nucleofector™ X Kits:

- P1 Primary Cell 4D-Nucleofector™ X Kit
- P3 Primary Cell 4D-Nucleofector™ X Kit

For subsequent experiments simply use the kit which yields the best results.

For highest convenience of the initial optimization step we recommend using the 16-well Nucleocuvette™ Strip format. Determined conditions are transferable to the 100 µl single Nucleocuvette™. However, you may also directly perform the optimization with the 100 µl single Nucleocuvette™ Format. If you have questions regarding your epithelial cells of interest, please contact our Scientific Support Team for further help with the optimization.

Product Description

Recommended Kit(s)—P1 Primary Cell 4D-Nucleofector™ X Kit or P3 Primary Cell 4D-Nucleofector™ X Kit

	P1 Primary Cell 4D-Nucleofector™ X Kit			P3 Primary Cell 4D-Nucleofector™ X Kit		
Cat. No.	**V4XP-1012**	**V4XP-1024**	**V4XP-1032**	**V4XP-3012**	**V4XP-3024**	**V4XP-3032**
Transfection volume	100 µl	100 µl	20 µl	100 µl	100 µl	20 µl
Size [reaction]	2 x 6	24	2 x 16	2 x 6	24	2 x 16
Nucleofector™ Solution	2 x 0.675 ml (0.492 ml + 27 % overfill)	2.25 ml (1.968 ml + 13 % overfill)	0.675 ml (0.525 ml + 22 % overfill)	2 x 0.675 ml (0.492 ml + 27 % overfill)	2.25 ml (1.968 ml + 13 % overfill)	0.675 ml (0.525 ml + 22 % overfill)
Supplement	2 x 0.15 ml (0.108 ml + 27 % overfill)	0.5 ml (0.432 ml + 13 % overfill)	0.15 ml (0.115 ml + 22 % overfill)	2 x 0.15 ml (0.108 ml + 27 % overfill)	0.5 ml (0.432 ml + 13 % overfill)	0.15 ml (0.115 ml + 22 % overfill)
pmaxGFP™ Vector (1 µg/µl in 10 mM Tris pH 8.0)	50 µg	50 µg	50 µg	50 µg	50 µg	50 µg
Single Nucleocuvette™ (100 µl)	12	24	-	12	24	-
16-well Nucleocuvette™ Strips (20 µl)	-	-	2	-	-	2

Storage and stability

Store Nucleofector™ Solution, Supplement and pmaxGFP™ Vector at 4 °C. For long-term storage, pmaxGFP™ Vector is ideally stored at -20 °C. The expiration date is printed on the solution box. Once the Nucleofector™ Supplement is added to the Nucleofector™ Solution, it is stable for three months at 4 °C.

Note

4D-Nucleofector™ Solutions can only be used with Nucleovettes™ (conductive polymer cuvettes), i.e. in the 4D-Nucleofector™ System and the 96-well Shuttle™ Device. They are not compatible with the Nucleofector™ II/2b Device.

Optimization Guidelines

The initial optimization experiment is comprised of 32 reactions, using 2 Nucleocuvette™ Strips: 7 different Nucleofector™ Programs are tested in duplicate with 2 4D-Nucleofector™ X Solutions plus 1 control.

The program and Nucleofector™ Solution which turns out to be the most appropriate Nucleofection™ Condition should be used for all subsequent transfections. A further fine tuning of the Nucleofection™ Condition can be performed with the help of our Scientific Support Team.

Nucleocuvette™ Strip 1: P1 Solution

	1	2
A	CM-102	CM-102
B	DC-100	DC-100
C	EA-104	EA-104
D	EL-110	EL-110
E	ED-100	ED-100
F	CM-113	CM-113
G	DS-109	DS-109
H	Negative control (no program)	Negative control (no program)

Nucleocuvette™ Strip 2: P3 Solution

	1	2
A	CM-102	CM-102
B	DC-100	DC-100
C	EA-104	EA-104
D	EL-110	EL-110
E	ED-100	ED-100
F	CM-113	CM-113
G	DS-109	DS-109
H	Negative control (no program)	Negative control (no program)

The P1 and P3 Primary Cell 4D-Nucleofector™ X Kits have been tested successfully for the following Clonetics™ Primary Cells provided by Lonza:

Cell type	Lonza Cat. No.	Optimal Program	Solution	Transf. efficiency	Viability*
HMEC (Human Mammary Epithelial Cells)	CC-2551	EL-110	P3	51 %	66 %
NHBE (Normal Human Bronchial Epithelial Cells)	"CC-2541	DC-100	P3	53 %	54 %
PrEC (Human Prostate Epithelial Cells)	CC-2555	CM-102	P1	67 %	48 %
SAEC (Human Small Airway Epithelial Cells)	CC-2547	EL-110	P3	64 %	75-100 %

*Determined by ViaLight™ Plus Kit, Lonza

Required Material

Note

Please make sure that the entire supplement is added to the Nucleofector™ Solution. The ratio of Nucleofector™ Solution to supplement is 4.5 : 1 (see table 1)

- 4D-Nucleofector™ System (4D-Nucleofector™ Core Unit and 4D-Nucleofector™ X Unit)
- Supplemented 4D-Nucleofector™ Solution at room temperature
- Supplied 100 µl single Nucleocuvette™ or 20 µl 16-well Nucleocuvette™ Strips
- **Compatible tips for 20 µl Nucleocuvette™ Strips:** epT.I.P.S. [US/CDN: Eppendorf North America, Cat. No. 2491.431, Rest of World: Eppendorf AG, Cat. No. 0030073.266], Matrix TallTips® [Matrix Technologies Corp., Cat. No. 7281] or LTS Tips [Rainin Instruments, LLC, Cat. No. SR-L10F, SR/SS-L250S, SR/SS-L300S]. Before using other types of pipette tips, please ensure they reach the bottom of the Nucleocuvette™ Wells without getting stuck
- **Supplied pmaxGFP™ Vector, stock solution 1µg/µl**

Note

For positive control using pmaxGFP™, dilute the stock solution to an appropriate working concentration. Further details are provided in table 3 of this Optimized Protocol. The volume of substrate solution added to each sample should not exceed 10% of the total reaction volume (2 µl for 20 µl reactions; 10 µl for 100 µl reactions).

- Substrate of interest, highly purified, preferably by using endotoxin-free kits; A260 : A280 ratio should be at least 1.8
- Cell culture plates of your choice
- **For trypsinization:** Please use trypsin as recommended by the cells supplier e.g. Reagent Pack™ Subculture Reagent Kit containing Trypsin/EDTA, HEPES Buffered Saline Solution (HBSS) and Trypsin Neutralizing Solution (TNS) [Lonza, Cat.No. CC-5034]
- **Culture medium:** Please use media as recommended by the cell supplier, e.g. PrEGM™ BulletKit™ for PrEC [Lonza; Cat. No. CC-3166], MEGM™ BulletKit™ for HMEC [Lonza; Cat. No. CC-3150], SAGM™ BulletKit™ for SAEC [Lonza; Cat. No. CC-3118] or BEGM™ BulletKit™ for NHBE [Lonza; Cat. No. CC-3170]) or the established standard growth media for the epithelial cells your are using supplemented with a suitable antimicrobial agents and e.g. 10 % FCS

– Prewarm appropriate volume of culture medium to 37 °C (see table 2)
– Appropriate number of cells/sample (see table 2)

1. Pre Nucleofection™

Notes

1. Transfection results may be donor-dependent.
2. Culture conditions may differ between cell types. Please follow your established procedure or the supplier's recommendations.

Cell culture recommendations

1.1 Seeding conditions: 2–6 x 10^3 cells/cm^2
1.2 Replace medium 2–3 times a week (15 ml per 75 cm^2 flask)
1.3 Cells should be passaged after reaching 80 % confluency
1.4 Do not use cells after passage 9 for Nucleofection™
1.5 Cells should be passaged 2 days before Nucleofection™ depending on growth rate of cells

Trypsinization

Note

Please follow your established procedure or the supplier's recommendations (e.g. for Reagent Pack™ Subculture Reagent Kit follow procedure described below).

1.6 Remove media from the cultured cells and wash cells once with HBSS; use at least same volume of HBSS as culture media
1.7 For harvesting, incubate the cells 4–6 minutes at 37 °C with recommended volume of indicated trypsinization reagent (please see required material)
1.8 Neutralize trypsinization reaction with TNS once the majority of the cells (>90 %) have been detached (not later than after 7 minutes as otherwise cells may start to clump)

2. Nucleofection™

For Nucleofection™ Sample contents and recommended Nucleofector™ Program, please refer to Table 3.

2.1 Please make sure that the entire supplement is added to the Nucleofector™ Solution
2.2 Start 4D-Nucleofector™ System and create or upload experimental parameter file (for details see device manual)
2.3 Select/Check for the appropriate Nucleofector™ Program (see table 3)
2.4 Prepare cell culture plates by filling appropriate number of wells with desired volume of recommended culture media (see table 4) and pre-incubate/equilibrate plates in a humidified 37 °C/5 % CO_2 incubator
2.5 Pre-warm an aliquot of culture medium to 37 °C (see table 4)
2.6 Prepare plasmid DNA or pmaxGFP™ Vector or siRNA (see table 3)
2.7 Harvest the cells by trypsinization (please see 1.6–1.8)
2.8 Count an aliquot of the cells and determine cell density
2.9 Centrifuge the required number of cells (see table 3) at 220xg for 5 minutes at room temperature. Remove supernatant completely
2.10 Resuspend the cell pellet carefully in room temperature 4D-Nucleofector™ Solution (see table 3)
2.11 Prepare mastermixes by dividing cell suspension according to number of substrates
2.12 Add required amount of substrates to each aliquot (max. 10 % of final sample volume)
2.13 Transfer mastermixes into the Nucleocuvette™ Vessels

Note

As leaving cells in Nucleofector™ Solution for extended periods of time may lead to reduced transfection efficiency and viability it is important to work as quickly as possible. Avoid air bubbles while pipetting.

2.14 Gently tap the Nucleocuvette™ Vessels to make sure the sample covers the bottom of the cuvette
2.15 Place Nucleocuvette™ Vessel with closed lid into the retainer of the 4D-Nucleofector™ X Unit. Check for proper orientation of the Nucleocuvette™ Vessel
2.16 Start Nucleofection™ Process by pressing the "Start" on the display of the 4D-Nucleofector™ Core Unit (for details, please refer to the device manual)
2.17 After run completion, carefully remove the Nucleocuvette™ Vessel from the retainer
2.18 Incubate Nucleocuvette™ 10 minutes at room temperature. Please note that this incubation may reduce cell viability and should be avoided if viability is a concern.
2.19 Resuspend cells with pre-warmed medium (for recommended volumes see table 5). Mix cells by gently pipetting up and down two to three times. When working with the 100 µl Nucleocuvette™ use the supplied pipettes and avoid repeated aspiration of the sample
2.20 Plate desired amount of cells in culture system of your choice (for recommended volumes see table 5)

3. Post Nucleofection™

3.1 Incubate the cells in humidified 37 °C/5 % CO_2 incubator until analysis. Gene expression or down regulation, respectively, is often detectable after only 4–8 hours

Additional Information

For an up-to-date list of all Nucleofector™ References, please refer to:
www.lonza.com/nucleofection-citations

For more technical assistance, contact our Scientific Support Team:

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Table 1: Volumes required for a single reaction

	100 µl Single Nucleocuvette™	20 µl Nucleocuvette™ Strip
Volume of Nucleofector™ Solution	82 µl	16.4 µl
Volume of Supplement	18 µl	3.6 µl

Table 2: Required amounts of cells and media for Nucleofection™

	100 µl Single Nucleocuvette™	20 µl Nucleocuvette™ Strip
Culture medium per sample post Nucleofection™ (for transfer and culture)	3.5 ml	230 µl
Cell number per Nucleofection™ Sample	0.5–1.5 x 10^6 cells per sample (Minimal cell number: 2 x 10^5 cells, a lower cell number may lead to major in crease in cell mortality; maximum cell number: 5 x 10^6)	0.5–1 x 10^5 cells (Lower or higher cell numbers may influence transfection results)

Table 3: Contents of one Nucleofection™ Sample and recommended program

		100 µl Single Nucleocuvette™	20 µl Nucleocuvette™ Strip
Cells		0.5–1 x 10^6	0.5–1 x 10^5 cells
Substrate*	**pmaxGFP™ Vector**	2 µg	0.4 µg
or	**plasmid DNA (in H_2O or TE)**	1–5 µg	0.4–1 µg
or	**siRNA**	30–300nM siRNA (3–30 pmol/sample)	30–300nM siRNA (0.6–6 pmol/sample)
P1 or P3 4D-Nucleofector™ X Solution		100 µl	20 µl
Program		CM-102 or CM-113 or DC-100 or EA-104 or EL-110 or ED-100 or DS-109	CM-102 or CM-113 or DC-100 or EA-104 or EL-110 or ED-100 or DS-109

* Volume of substrate should comprise maximum 10 % of total reaction volume

Table 4: Culture volumes required for post Nucleofection™ Steps

	100 µl Single Nucleocuvette™	20 µl Nucleocuvette™ Strip*
6 cm culture dishes	3 ml	-
96-well culture plate	-	150 µl
Culture medium to be added to the sample post Nucleofection™	500 µl	80 µl

* Maximum cuvette volume 200 µl

Table 5: Recommended volumes for sample transfer into culture plate

	100 µl Single Nucleocuvette™	20 µl Nucleocuvette™ Strip*
Culture medium to be added to the sample post Nucleofection™	500 µl	80 µl
Volume of sample transferred to culture plate	complete sample (use supplied pipettes)	50 µl

* Maximum cuvette volume 200 µl