NEPAGENE

ELEPO21

In Vitro High Energy Electroporator

Bacterial Cells, Mammalian Cells and More

Hi Voltage Electroporation

Transformation of

- Bacterial Cells

- Fungi, Yeasts, etc.

Up to 3,000 Volt pulses at **millisecond** (not microsecond) range can be delivered.
Remarkably higher transformation efficiency than traditional electroporation

Low Voltage Electroporation

Transfection of

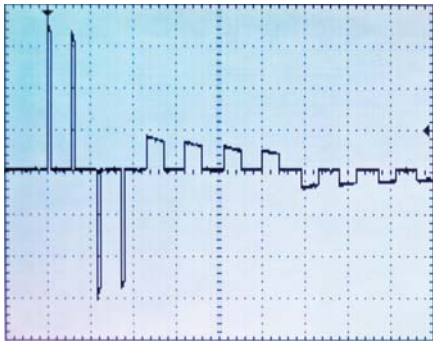
- Primary Cell Cultures

- Any Cell Lines (animal cells and plant cells)

- Stem Cells, ES Cells, iPS Cells, etc.

High transfection efficiency and high viability without special buffer

ELEPO21 4-Step Multiple Electroporation Pulses



Step 1: Poring Pulse Mode *higher voltage, shorter duration, multiple pulses, natural voltage decay*
This is for forming pores (small holes) in cell membrane with minimum damage.

Step 2: Polarity Exchanged Poring Pulse
The polarity of Poring Pulse can be reveresed.

Step 3: Transfer Pulse Mode *lower voltage, longer duration, multiple pulses, natural voltage dcay*
This is for delivering the target molecules into cells with minimum damage.

Step 4: Polarity Exchanged Transfer Pulse
This can increase the transfection efficiency.

Hi Voltage Electroporation for Bacterial Cells, Fungi, Yeast, etc.

The ELEPO21 In Vitro High Energy Electroporator developed by Nepa Gene Co., Ltd. has a unique pulsing system composed of 4-step multiple pulses with decaying, and it can achieve **transformation efficiency remarkably higher** than traditional methods that use a single-step exponential pulse wave in bacteria, yeasts, and fungi.

- Transformation data of bacteria (E. coli) -

We measured gene transfer efficiency using the ELEPO21 in Gram-negative bacteria. Competent cells were prepared as usual from E. coli DH5α. The competent cells were mixed with pUC19 DNA, and a 20μl aliquot (containing 109-1011 cells and 10 pg DNA in 10% glycerol solution) was transferred to the 1 mm gap electrode cuvette (EC-001, Nepa Gene). The cuvette was set in the chamber connected to the ELEPO21, and delivered 3-step pulses as described below. All steps were done on ice. After electroporation, the cells were plated on LB agarose medium containing ampicillin, and colonies formed were counted. Transformation efficiency was expressed as a number of colonies per μg plasmid DNA used.

[ELEPO21 pulsing conditions, Fig. 1]

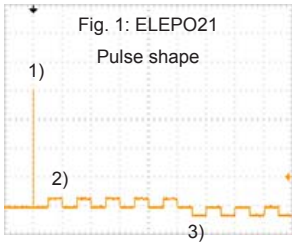
Poring Pulse（voltage: 2,000 V, pulse length：2.5 msec, pulse interval：50 ms, number of pulse：1, polarity：+）

Transfer Pulse（voltage: 150 V, pulse length：50 msec, pulse interval：50 ms, number of pulse：5, polarity：+/-）

To evaluate the above results, we measured gene transfer efficiencies using a conventional electroporator (ECM630, BTX) that deliver a single exponential pulse as described below.

[ECM630 pulsing conditions, Fig. 2]

Single pulse (voltage：2,000 V, resistance：200Ω, capacitance：25μF, number of pulse：1)



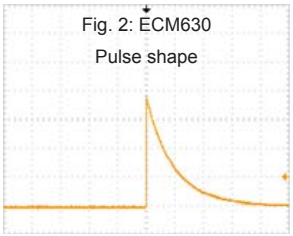


Fig. 3

E. coli DH5α		ELEPO21	ECM630
Efficiency	x 10^{10} cfu	1.40±0.07	0.29±0.11
	Relative Value	4.9	1.0

Experimental results

The above cell suspensions (sample resistance value：7.7 KΩ) were used for electroporation. **The tranformation efficiency obtained by the ELEPO21 electroporator was approximately 5 times higher** than that by the ECM630 electroporator (Fig. 3).

Fig. 1：Multi-step pulses by the ELEPO21

1) Poring pulse 2) Transfer pulse (+) 3) Transfer pulse (-)

※ The values are averages of repeated experiments.

※ The optimum pulsing conditions were used for ELEPO21 and ECM630.

※ cfu: colony forming unit.

- Transformation data of Yeast (S. cerevisiae) -

We measured gene transfer efficiency using the ELEPO21 in yeast. Competent cells were prepared as usual from budding yeast S. cerevisiae. The competent cells were mixed with pAS2 DNA, and a 20μl aliquot (containing 108-1010 cells and 50 ng DNA in 1M sorbitol solution) was transferred to the 1 mm gap electrode cuvette (EC-001, Nepa Gene). The cuvette was set in the chamber connected to the ELEPO21, and delivered 3-step pulses as described below. All steps were done on ice. After electroporation, the cells were plated on selective agarose medium devoid of nutrients, and the colonies formed were counted. Transformation efficiency was expessed as a number of colonieis per μg plasmid DNA.

[ELEPO21 pulsing conditions, Fig. 1]

Poring Pulse（voltage: 2,000 V, pulse length：2.5 msec, pulse interval：50 ms, number of pulse：1, polarity：+）Transfer Pulse（voltage: 150 V, pulse length：50 msec, pulse interval：50 ms, number of pulse：5, polarity：+/-）

To evaluate the above results, we measured gene transfer efficiencies using a conventional electroporator (ECM630, BTX) that deliver a single exponential pulse as described below.

[ECM630 pulsing conditions, Fig. 2]

Single pulse (voltage：2,000 V, resistance：200Ω, capacitance：25μF, number of pulse：1)

Fig. 1

Fig. 2

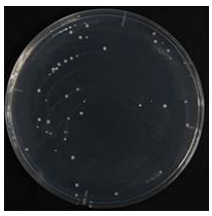


Fig. 3

S. Cerevisiae FY24		ELEPO21	ECM630
Efficiency	x 10^{4} cfu	2.49±0.24	0.40±0.11
	Relative Value	6.3	1.0

Experimental results

The above cell suspensions (sample resistance value：12.36 KΩ) were used for electroporation. **The tranformation efficiency obtained by the ELEPO21 electroporator was approximately 6 times higher** than that by the ECM630 electroporator (Fig. 3).

※ The values are averages of repeated experiments.

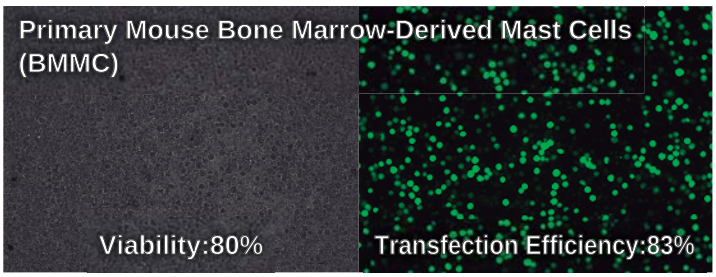
※ The optimum pulsing conditions were used for ELEPO21 and ECM630.

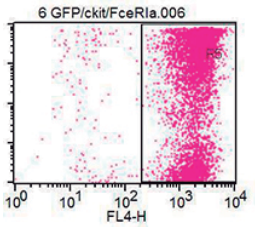
※ cfu: colony forming unit.

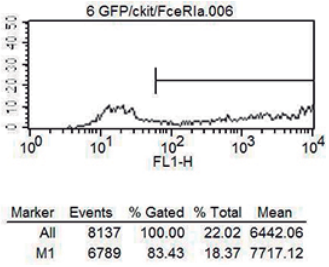
Low Voltage Electroporation for Cell Cultures

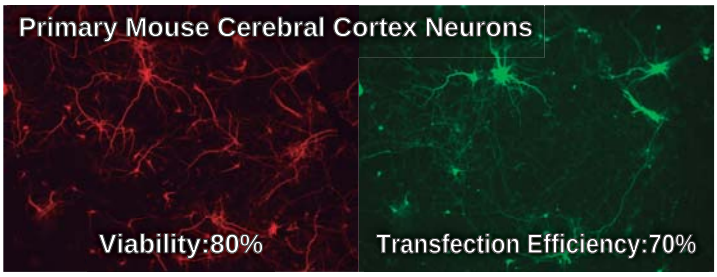
The ELEPO21 makes it possible to achieve high transfection efficiency and viability without resourse to special buffers for **difficult-to-transfect cells such as PRIMARY CELLS, STEM CELLS, IMMUNE CELLS, BLOOD CELLS, etc.**

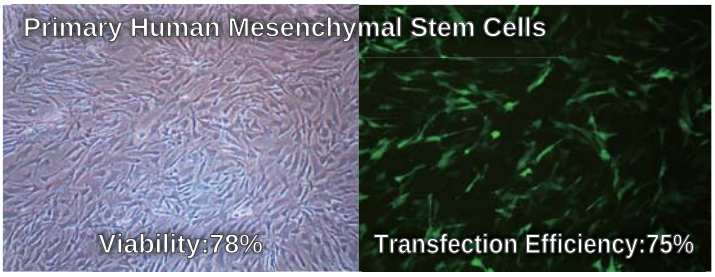
- Transfection data of primary cell cultures, stem cells and more -

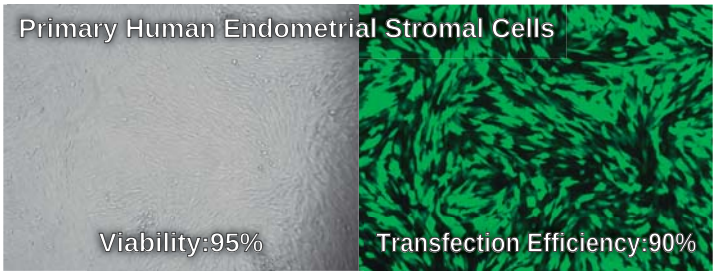


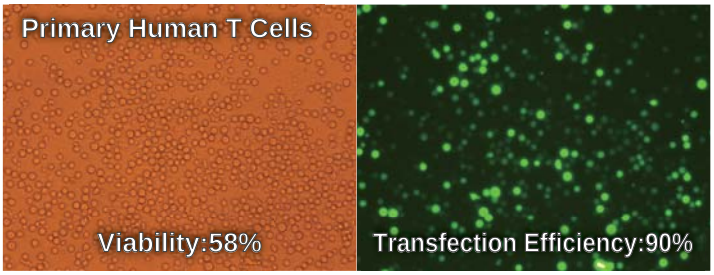


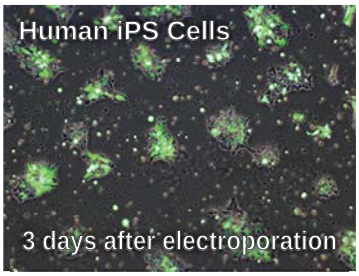


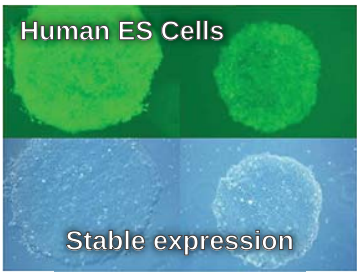


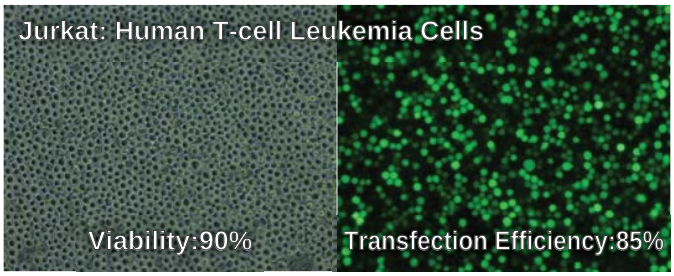












High Transfection Performance WITHOUT Special Buffers

Comparison with Competitors

Transfection Device	ELEPO21 (Nepa Gene)	N (Company L)	N (Company I(L))
Characteristics	New Electroporation No Special Buffers	Electroporation and Special Buffers	Electroporation and Special Buffers
Consumables (Disposable Kits)	Economy Cuvettes USD 2.00/reaction	Special Kits USD 20.00/reaction	Special Kits USD 20.00/reaction

The running cost of the ELEPO21 is much lower than other transfection devices!

Low Voltage Electroporation for Cell Cultures

Cell-Culture Transfection Data*

	V**	TE***
Primary HUVEC	95%	75%
Primary Human Airway Smooth Muscle cells	90%	80%
Primary Human Endometrial Stromal cells	95%	90%
Primary Human Dermal Fibroblasts	95%	89%
Primary Human T cells	58%	90%
Primary PBMC	93%	66%
Human Chronic Lymphocytic Leukemia (CLL)	82%	70%
Primary Mouse Cerebral Cortex Neurons	80%	70%
Primary Mouse Hippocampal Neurons	80%	60%
Primary Mouse Neural Progenitor cells	80%	60%
Primary Mouse DRG Neurons	70%	70%
Primary MEF	90%	85%
Primary BMMC	80%	83%
Primary Mouse Liver cells	70%	50%
Primary Rat Schwann cells	90%	80%
Primary Chick Embryonic Fibroblasts	80%	90%
Primary Goat Embryonic Epithelial Fibroblasts	80%	55%
Primary Human Mesenchymal Stem cells	78%	75%
Human iPS cells	90%	79%
Mouse ES cells	80%	90%
Mouse iPS cell derived Neural Stem cells		86%
Mouse Neural Stem cells	90%	80%
Mouse Neurospheres	90%	75%

		V**	TE***
HEK293	Human Embryonic Kidney cells	92%	91%
HEK293T	Human Embryonic Kidney cells	90%	95%
HDF	Human Dermal Fibroblasts (106-05)	90%	90%
HaCat	Human Keratinocyte cells	96%	75%
BEAS-2B	Human Bronchial Epithelial cells	75%	96%
SUSM-1	Human Fibroblasts	77%	71%
HT1080	Human Fibrosarcoma cells	93%	81%
U2OS	Human Osteosarcoma cells	70%	80%
PANC-1	Human Pancreatic Carcinoma cells	55%	69%
MIA-PaCa-2	Human Pancreatic Carcinoma cells	80%	77%
HepG2	Human Hepatoma cells	88%	76%
HuH-7	Human Hepatoma cells	82%	85%
H69	Human Small-Cell Lung Cancer cells	90%	85%
H1299	Human Lung Cancer cells	90%	90%
A549	Human Lung Adenocarcinoma cells	85%	90%
MCF 10A	Human Breast Cells	90%	80%
MCF-7	Human Breast Cancer cells	80%	70%
HCT116	Human Colon Cancer cells	95%	90%
Caco-2	Human Colon Cancer cellss	95%	80%

		V**	TE***
HeLa	Human Cervical Carcinoma cells	87%	93%
OVCAR-3	Human Ovarian Carcinoma cells	90%	79%
RMG-1	Human Ovarian Clear Cell Adenocarcinoma	97%	67%
PC-3	Human Prostate Cancer cells	90%	95%
SH-SY5Y	Human Neuroblastoma cells	60%	90%
NB69	Human Neuroblastoma cells	95%	80%
iHAM-4	Human Amniotic Mesenchymal cells	59%	95%
	Human Dental Pulp cells	90%	85%
RPE	Retinal Pigment Epithelium cells	90%	70%
Jurkat	Human T-cell Leukemia cells	95%	95%
Nalm-6	Human B-cell Precursor Leukemia cells	77%	82%
KG-1	Human Acute Myeloid Leukemia cells	70%	65%
K562	Human Chronic Myelogenous Leukemia cells	91%	99%
THP-1	Human Acute Monocytic Leukemia cells	85%	67%
HL-60	Human Promyelocytic Leukemia cells	80%	80%
697	Human Pre-B Acute Lymphoblastic Leukemia cells	79%	72%
Ramos	Human Burkitt Lymphoma cells	83%	57%
BJAB	Human EBV-negative Burkitt Lymphoma cells	96%	96%

		V**	TE***
NIH/3T3	Mouse Embryonic Fibroblasts	74%	81%
3T3-L1	Mouse Embryonic Fibroblasts	90%	90%
MEF	Mouse Embryonic Fibroblasts	80%	90%
HL-1	Mouse Cardiac Muscle cells	70%	70%
C2C12	Mouse Myoblast cells	94%	90%
Neuro-2a	Mouse Neuroblastoma cells	90%	90%
BV-2	Mouse Melanoma cells	65%	70%
MIN6	Mouse Pancreatic Beta cells	70%	56%
WR19L	Mouse T-cell lymphoma cells	92%	60%
RAW264.7	Mouse Macrophage-like cells	57%	71%
J774.1	Mouse Macrophage-like cells	100%	70%
BA/F3	Mouse pro-B cells	90%	90%
mDC	Mouse Myeloid Dendritic cells	79%	72%
MC/9	Mouse Mast cells	76%	84%

		V**	TE***
PC12	Rat Adrenal Pheochromocytoma cells	90%	70%
H9c2	Rat Ventricular Myoblasts	75%	80%
TtT/GF	Rat Anterior Pituitary cells	65%	83%

		V**	TE***
CHO	Chinese Hamster Ovary Cells	74%	90%
CHO-K1	Chinese Hamster Ovary Cells	95%	95%
COS-7	African Green Monkey Kidney fibroblasts	61%	89%
MDCK	Madrin-Darby Canine Kidney Cells	90%	95%
BFF	Bovine Fetal Fibroblasts	78%	72%
BAFC	Bovine Aortic Endothelial Cells	80%	80%

*The transfection data above are mostly from the NEPA21 but we confirm that the ELEPO21 can achieve consistent results similar to the NEPA21.

**V: Viability ***TE: Transfection Efficiency

NEPAGENE

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