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Transfection into PRIMARY CELL CULTURES by Electroporation

The NEPA21 is the only device on the market to approach **PRIMARY CELL CULTURES** Electroporation from the perspective of optimising delivered energy.

- The finer control over the delivered energy available with the NEPA21 offers specific and important advantages for stem cell electroporation. As the thrust of NEPA21 protocols is to minimise delivered energy, this means that the targets are electroporated with less current (than competing device protocols).
- For particularly sensitive and delicate targets, identifying and only delivering the required energy (and no more) to porate the membrane is of utmost importance for their viability post electroporation.
- The success of the NEPA21 for cell electroporation is evident by the number of laboratories what have published with the NEPA21 system, and the quantum of client laboratory verified Viability % and Transfection Efficiency %.
- The NEPA21 system is supported by a suite of over 250 different electrode configurations, which further enhance the applicability of the system and empower researchers with further experimental options and opportunities.

See page below

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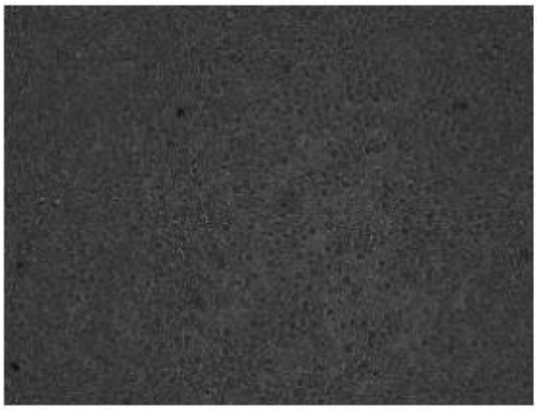
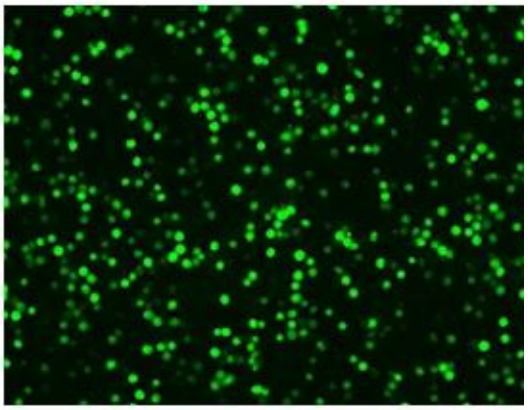
APPLICATIONS

Transfection into PRIMARY CELL CULTURES by Electroporation

Primary Mouse Bone Marrow-Derived Mast cells

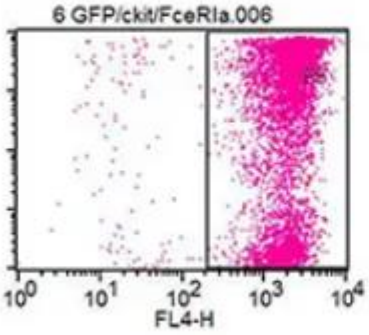


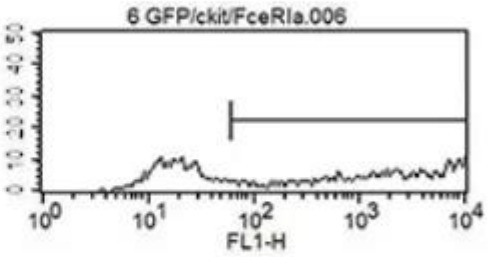


Viability: 80%

Transfection Efficiency: 83%

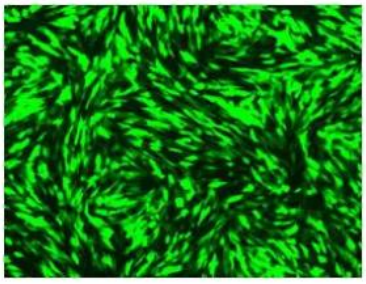
FACS





Marker	Events	% Gated	% Total	Mean
All	8137	100.00	22.02	6442.06
M1	6789	83.43	18.37	7717.12

Primary Mouse Cerebral Cortex Neurons (E14)



Viability: 95 %

Transfection Efficiency: 90 %

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Transfection Data: Primary Human Cells

See the cell images by clicking the cell names.
V: Viability, TE: Transfection Efficiency.

Client Laboratory Verified RESULTS

Primary Cells	V	TE		Primary Cells	V	TE
HUVEC Human Umbilical Vein Endothelial Cells	95%	75%		HUVEC Human Umbilical Vein Endothelial Cells	100%	92%
HASM Human Airway Smooth Muscle Cells	90%	80%		Human Coronary-derived Smooth Muscle Cells	82%	67%
Human Endometrial Stromal Cells	95%	90%		Human Uterine Cervical Fibroblasts	65%	90%
Human Dermal Fibroblasts (HDF)	95%	89 %		Human Dermal Fibroblasts (HDF)	100%	80%
Human Keratinocytes	70%	65%		Human Malignant Mesothelioma Cells	75%	55 %
Human Meniscal Cells	85%	55%		Human Colorectal Cells	53%	80%
Human T Cells	58%	90%		Human T Cells	50%	76%
Human NK Cells	48%	86%		PBMC Peripheral Blood Mononuclear Cells	93%	66%
Human Erythroblasts (CD34+ Progenitor Cells)	61 %	34 %		Human Chronic Lymphocytic Leukemia (CLL)	82%	70%
Human Chronic Lymphocytic Leukemia (CLL) (mRNA)	93 %	94%		Human Chronic Lymphocytic Leukemia (CLL)	91%	83%
Human Chronic Lymphocytic Leukemia (CLL)	83%	93%		Human Osteoblast-like Cells derived from human skull	64%	74%

Client laboratories have provided us with a large suite of results.
Please feel free to contact us for the latest results data: sales@sonidel.com

Transfection Data: Primary Mouse Cells

See the cell images by clicking the cell names.
V: Viability, TE: Transfection Efficiency.

Client Laboratory Verified RESULTS

Primary Cells	V	TE		Primary Cells	V	TE
Mouse Cerebral Cortex Neurons (E14)	80%	70%		Mouse Hippocampal Neurons (E14)	80%	60%
Mouse Hippocampal Neurons (E17)	65%	70%		Mouse Neural Progenitor Cells	80%	60%
Mouse Basal Ganglia Primordium	91%	71%		Mouse Cerebellar Granule Neurons	91%	65%
Mouse DRG Neurons	83%	68%		Mouse DRG Neurons	70%	70%
MEF Mouse Embryonic Fibroblasts	90%	85%		MEF Mouse Embryonic Fibroblasts	75%	85%
Mouse Embryonic Skin Fibroblasts	80%	50%				
Mouse External Genital Fibroblasts (E15.5)	66%	59%		Mouse Cervical Epithelial Cells	82%	55%
Mouse Vascular Adventitial Fibroblasts	90%	50%		BMMC Mouse Bone Marrow-Derived Mast Cells	80%	83%
Mouse peritoneal macrophages	69%	41%		Mouse B cells (LPS stimulated)	81%	73%
Mouse B cells	50%	61%		Mouse B cells (Unstimulated)	84%	83%
Mouse T cells (siRNA)	88%	77%		Naive Mouse CD8+ T cells (Cas9 RNP)	50%	95%
Mouse Liver Cells	75%	65%		Mouse Osteoblast Cells	85%	60%
Mouse Muscle Cells	68%	54%				

Client laboratories have provided us with a large suite of results.
Please feel free to contact us for the latest results data: sales@sonidel.com

Transfection Data: Primary Rat Cells

See the cell images by clicking the cell names.
V: Viability, TE: Transfection Efficiency.

Primary Cells	V	TE		Primary Cells	V	TE
Rat Cerebral Cortex Neurons (E16)	70%	75%		Rat Hippocampal Neurons	60%	80%
Rat Bulbar Neurons	80%	75%		Rat Cerebellar Neurons	70%	55%
Rat Cerebellar Granule Cells	70%	80%		Rat Schwann Cells	90%	80%
Rat Schwann Cells	90%	60%		OEC Rat Olfactory Ensheathing Cells	93%	46%
Rat Müller Cells	90%	50%		REF Rat Embryonic Fibroblasts	65%	65%
Rat Meningeal Fibroblasts	90%	95%		PASMC Rat Pulmonary Artery Smooth Muscle Cells	72%	70%

Client laboratories have provided us with a large suite of results.
Please feel free to contact us for the latest results data: sales@sonidel.com

Transfection Data: Other Primary Cells

See the cell images by clicking the cell names.
V: Viability, TE: Transfection Efficiency.

Primary Cells	V	TE		Primary Cells	V	TE
Chick Embryonic Fibroblasts	80%	90%		Chick Embryonic Cerebellar Granule Cells	86%	83%
Bovine Cartilage Cells	96%	55%		Goat Embryonic Epithelial Fibroblasts	80%	55%
Rabbit Spleen cells (B cells)	70%	45%		Canine Adipose-Derived Stromal Cells (ADSCs)		65%

Client laboratories have provided us with a large suite of results.
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PUBLICATIONS

Transfection into PRIMARY CELL CULTURES by Electroporation

Primary MOUSE Neurons Cells

ALS-associated C21ORF2 variant disrupts DNA damage repair, mitochondrial metabolism, neuronal excitability and NEK1 levels in human motor neurons
Zelina P, de Ruiter AA, Kolsteeg C, van Ginneken I, Vos HR, Supiot LF, Burgering BMT, Meye FJ, Veldink JH, van den Berg LH, Pasterkamp RJ.
Acta Neuropathol Commun. 2024 Sep 4;12(1):144.

T lymphocytes

CD3-activated T-lymphocytes
Differential impact of genetic deletion of TIGIT or PD-1 on melanoma-specific T-lymphocytes
Differential impact of genetic deletion of TIGIT or PD-1 on melanoma-specific T-lymphocytesCadiou G, Beauvais T, Marotte L, Lambot S, Deleine C, Vignes C, Gantier M, Hussong M, Rulli S, Jarry A, Simon S, Malissen B, Labarriere N.
Oncoimmunology. 2024 Jul 8;13(1):2376782.

Primary RAT Neurons Cells

ARHGEF5 binds Drebrin and affects α-tubulin acetylation to direct neuronal morphogenesis and migration during mouse brain development
Kim JY, Hwang HG, Jeon HJ, Kim SI, Kim MK, Kim JY.
Front Mol Neurosci. 2024 Jun 12:17:1421932.

The Transcription Factor Ets1 Influences Axonal Growth via Regulation of Lcn2
Gu M, Li X, Wu R, Cheng X, Zhou S, Gu X.
Mol Neurobiol. 2024 Feb;61(2):971-981

Expression of Channelrhodopsin-2 Using in Suspension Electroporation for Studying the Monosynaptic Transmission in Neuronal Culture
Natalia Bal, Aleksey Malyshev, Ivan Smirnov, Pavel Balaban
BioNanoScience 6, 329–331(2016)

(S)-ZJM-289 Preconditioning Induces a Late Phase Protection Against Nervous Injury Induced by Transient Cerebral Ischemia and Oxygen-Glucose Deprivation
Zhang C, Zhang Z, Zhao Q, Wang X, Ji H, Zhang Y.
Neurotox Res , 26 (1), 16-31 Jul 2014

Primary MOUSE Neurons Cells

OTX1 regulates cell cycle progression of neural progenitors in the developing cerebral cortex
Huang B, Li X, Tu X, Zhao W, Zhu D, Feng Y, Si X, Chen JG
J Biol Chem. 2018 Feb 9;293(6):2137-2148.

Endocytosis following dopamine D2 receptor activation is critical for neuronal activity and dendritic spine formation via Rabex-5/PDGFRβ signaling in striatopallidal medium spiny neurons
Shioda N, Yabuki Y, Wang Y, Uchigashima M, Hikida T, Sasaoka T, Mori H, Watanabe M, Sasahara M, Fukunaga K
Mol Psychiatry. 2017 Aug;22(8):1205-1222.

BMDM

Tobacco-induced hyperglycemia promotes lung cancer progression via cancer cell-macrophage interaction through paracrine IGF2/IR/NPM1-driven PD-L1 expression
Jang HJ, Min HY, Kang YP, Boo HJ, Kim J, Ahn JH, Oh SH, Jung JH, Park CS, Park JS, Kim SY, Lee HY.
Nat Commun. 2024 Jun 8;15(1):4909.

Human T cells

ScRNA-seq reveals novel immune-suppressive T cells and investigates CMV-TCR-T cells cytotoxicity against GBM
Long X, Zhang Z, Li Y, Deng K, Gao W, Huang M, Wang X, Lin X, She X, Zhao Y, Zhang M, Huang C, Wang S, Du Y, Du P, Chen S, Liu Q, Wu M.
J Immunother Cancer. 2024 Apr 30;12(4):e008967.

Epigenetic profiles guide improved CRISPR/Cas9-mediated gene knockout in human T cells
Ito Y, Inoue S, Nakashima T, Zhang H, Li Y, Kasuya H, Matsukawa T, Wu Z, Yoshikawa T, Kataoka M, Ishikawa T, Kagoya Y.
Nucleic Acids Res. 2024 Jan 11;52(1):141-153.

Genetic ablation of PRDM1 in antitumor T cells enhances therapeutic efficacy of adoptive immunotherapy
Yoshikawa T, Wu Z, Inoue S, Kasuya H, Matsushita H, Takahashi Y, Kuroda H, Hosoda W, Suzuki S, Kagoya Y.
Blood. 2022 Apr 7;139(14):2156-2172.

Large-scale expansion of Vγ9Vδ2 T cells with engineered K562 feeder cells in G-Rex vessels and their use as chimeric antigen receptor-modified effector cells.
Xiao L, Chen C, Li Z, Zhu S, Tay JC, Zhang X, Zha S, Zeng J, Tan WK, Liu X, Chng WJ, Wang S
Cytotherapy. 2018 Mar;20(3):420-435.

Primary Human T cells

Intraperitoneal immunotherapy with T cells stably and transiently expressing anti-EpCAM CAR in xenograft models of peritoneal carcinomatosis
Ang WX, Li Z, Chi Z, Du SH, Chen C, Tay JC1, Toh HC, Connolly JE, Xu XH, Wang S
Oncotarget. 2017 Feb 21;8(8):13545-13559.

Co-Expansion of Cytokine-Induced Killer Cells and Vγ9Vδ2 T Cells for CAR T-Cell Therapy
Du SH, Li Z, Chen C, Tan WK, Chi Z, Kwang TW, Xu XH, Wang S
PLoS One. 2016 Sep 6;11(9):e0161820.

Primary chondrocytes

Cartilage stem/progenitor cells-derived exosomes facilitate knee cartilage repair in a subacute osteoarthritis rat model
Chen J, Ni X, Yang J, Yang H, Liu X, Chen M, Sun C, Wang Y.
J Cell Mol Med. 2024 Apr;28(8):e18327.

Human monocytes

Systematic identification of gene combinations to target in innate immune cells to enhance T cell activation
Xia L, Komissarova A, Jacover A, Shovman Y, Arcila-Barrera S, Tornovsky-Babeay S, Jaya Prakashan MM, Nasereddin A, Plaschkes I, Nevo Y, Shiff I, Yosefov-Levi O, Izhiman T, Medvedev E, Eilon E, Wilensky A, Yona S, Parnas O.
Nat Commun. 2023 Oct 9;14(1):6295.

Primary MOUSE hematopoietic stem cells_(HSCs)

Non-viral ex vivo genome-editing in mouse bona fide hematopoietic stem cells with CRISPR/Cas9
HoSuvd Byambaa, Hideki Uosaki, Tsukasa Ohmori, Hiromasa Hara, Hitoshi Endo, Osamu Nureki, Yutaka Hanazono
Mol Ther Methods Clin Dev. 2021 Jan 9:20:451-462.

Primary HUMAN NK Cells

CXCR1 Expression to Improve Anti-Cancer Efficacy of Intravenously Injected CAR-NK Cells in Mice With Peritoneal Xenografts
Yu Yang Ng, Johan C K Tay, Shu Wang
Mol Ther Oncolytics. 2019 Dec 24:16:75-85.

Adoptive Transfer of NKG2D CAR mRNA-Engineered Natural Killer Cells in Colorectal Cancer Patients
Lin Xiao, Dongzhi Cen, Haining Gan, Yan Sun, Nanqi Huang, Hanzhen Xiong, Qiongmei Jin, Liqun Su, Xuejuan Liu, Kejian Wang, Guangrong Yan, Tianfa Dong, Shangbiao Wu, Pengzhi Zhou, Jinshan Zhang, Weixiang Liang, Junlan Ren, Yaoshu Teng, Can Chen, Xue Hu Xu
Mol Ther, 27 (6), 1114-1125 2019 Jun 5

Primary HUMAN Hepatocytes

CXCR4 Regulates Plasmodium Development in Mouse and Human Hepatocytes
Hironori Bando, Ariel Pradipta, Shiroh Iwanaga, Toru Okamoto, Daisuke Okuzaki, Shun Tanaka, Joel Vega-Rodríguez, Youngae Lee, Ji Su Ma, Naoya Sakaguchi, Akira Soga, Shinya Fukumoto, Miwa Sasai, Yoshiharu Matsuura, Masao Yuda, Marcelo Jacobs-Lorena, Masahiro Yamamoto
J Exp Med. 2019 Aug 5;216(8):1733-1748.

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Primary HUMAN Skin Fibroblasts

Reduced recruitment of 53BP1 during interstrand crosslink repair is associated with genetically inherited attenuation of mitomycin C sensitivity in a family with Fanconi anemia
Lesport E, Ferster A, Biver A, Roch B, Vasquez N, Jabado N, Vives FL, Revy P, Soulier J, de Villartay JP
Oncotarget. 2017 Dec 17;9(3):3779-3793.

A sister of NANOG regulates genes expressed in pre-implantation human development.
Dunwell TL, Holland PWH
Open Biol. 2017 Apr;7(4). pii: 170027.

Evolutionary origin and functional divergence of totipotent cell homeobox genes in eutherian mammals
Maeso I, Dunwell TL, Wyatt CD, Marlétaz F, Vető B, Bernal JA, Quah S, Irimia M, Holland PW
BMC Biol. 2016 Jun 13;14:45.

PBMC and Primary Human T Cells

Enhancement of antitumor activity by using a fully human gene encoding a single-chain fragmented antibody specific for carcinoembryonic antigen.
Shibaguchi H, Luo N, Shirasu N, Kuroki M, Kuroki M
Onco Targets Ther. 2017 Aug 22;10:3979-3990.

Primary Rhesus Macaque CD4+ T cells

Targeting the rhesus macaque TRIM5α gene to enhance the susceptibility of CD4+ T cells to HIV-1 infection
Wang X, Yu Q, Yuan Y, Teng Z3, Li D, Zeng Y
Arch Virol. 2017 Mar;162(3):793-798.

Primary MOUSE Astrocytes

Novel Rac1-GSPT1 Signaling Pathway Controls Astrogliosis Following Central Nervous System Injury
Ishii T, Ueyama T, Shigyo M, Kohta M, Kondoh T, Kuboyama T, Uebi T, Hamada T, Gutmann DH, Aiba A, Kohmura E, Tohda C, Saito N
J Biol Chem. 2017 Jan 27;292(4):1240-1250.

BMMCs

Primary Mouse Bone Marrow-Derived Mast cells (BMMCs)
Real-time imaging of mast cell degranulation in vitro and in vivo
Horiguchi K, Yoshikawa S, Saito A, Haddad S, Ohta T, Miyake K, Yamanishi Y, Karasuyama H
Biochem Biophys Res Commun. 2016 Oct 21;479(3):517-522.

Primary Porcine Dermal Fibroblasts, Kidney Fibroblasts, and Myoblasts

Efficient modification of the myostatin gene in porcine somatic cells and generation of knockout piglets
Rao S, Fujimura T, Matsunari H, Sakuma T, Nakano K, Watanabe M, Asano Y, Kitagawa E, Yamamoto T, Nagashima H
Mol Reprod Dev. 2016 Jan;83(1):61-70.

hMSCs

Novel SCRG1/BST1 axis regulates self-renewal, migration, and osteogenic differentiation potential in mesenchymal stem cells
Aomatsu E, Takahashi N, Sawada S, Okubo N, Hasegawa T, Taira M, Miura H, Ishisaki A, Chosa N.
Sci Rep. 2014 Jan 13:4:3652.

Primary Mouse Hippocampus & Cerebral Cortex Neurons Cells

Shootin1 Acts in Concert with KIF20B to Promote Polarization of Migrating Neurons.
Sapir T, Levy T, Sakakibara A, Rabinkov A, Miyata T, Reiner O.
J Neurosci. 2013 Jul 17;33(29):11932-48.

Primary Mouse CGE, MGE, & Cerebral Cortex Nerve Cells

Leucine-rich glioma inactivated 1 (Lgi1), an epilepsy-related secreted protein, has a nuclear localization signal and localizes to both the cytoplasm and the nucleus of the caudal ganglionic eminence neurons.
Kusuzawa S, Honda T, Fukata Y, Fukata M, Kanatani S, Tanaka DH, Nakajima K.
Eur J Neurosci. 2012 Aug;36(3):2284-92.

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ACCESSORIES

Transfection into PRIMARY CELL CULTURES by Electroporation

Cuvette Chamber and Stand Holder

NEPA Cuvettes: 1mm, 2mm and 4mm