NanoEntek

Transfection Introduction

What is Gene Delivery?

Gene delivery is the process of

introducing foreign genetic material (DNA or RNA) into cells

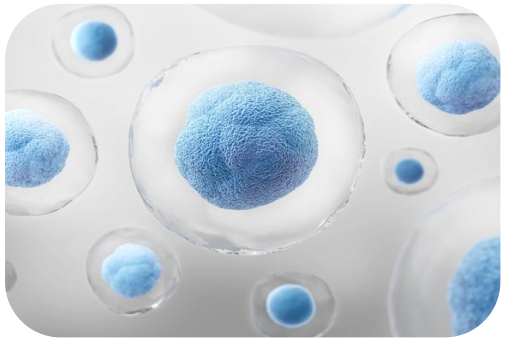
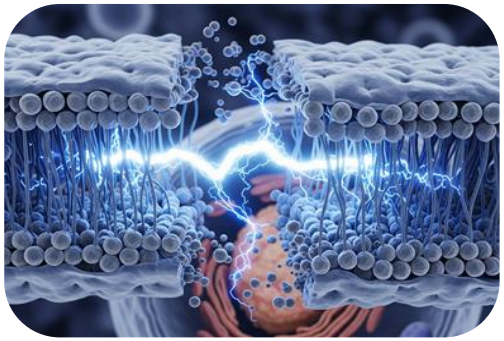
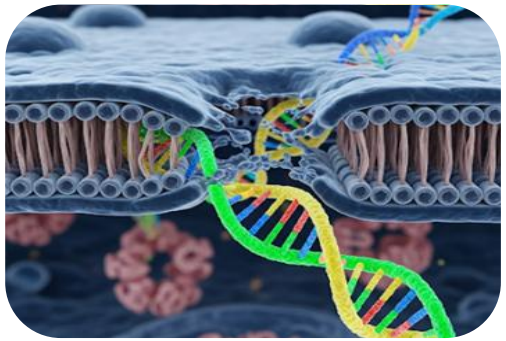
to modify or study their function.

1. What is Gene Delivery?

Types of genetic material insertion method

Transfection	Transformation	Transduction
Inserting DNA/RNA into eukaryotic cells	A **bacteria** take up DNA and incorporate it into their own genome	Using a **virus** to transport DNA/RNA into cells

1. What is Gene Delivery?

Step 1	Step 2	Step 3
		
Healthy cells with well-structured cell membrane	Temporary breakage of cell membrane (e.g. electroporation)	DNA or RNA inserted into cells

Normally, cell does not absorb(allow) foreign substances without channels for specific substances with access. It only allows specific substances inside, which requires complex and strict steps.

Transfection is the key that makes this process a lot easier.

2. Purpose of Gene Delivery

Each cell produces proteins based on the genetic information.

This also means that we can manipulate cells by inserting the information we want to produce new protein or target protein.

Consideration 1

What would happen if we could choose the function of a cell?

Consideration 2

What if we could make a cell to only produce specific protein? Or make a cell into something totally different?

2. Purpose of Gene Delivery

Generally to either manipulate cells to have specific genetic information or to study treatment

Nintendo Switch = host cell

Cartridge = DNA or RNA

Purpose 1

For novel **drug development** and disease treatment research

Purpose 2

To **study gene expression**

Purpose 3

To **produce target protein**

2. Purpose of Gene Delivery

Novel drug development & research

- To study a way to fix the abnormal cells or to treat a genetic disease
- Widely used by inserting suicide gene inside cancer cells or inserting normal gene into a patient with genetic disorder
- E.g.) replacing old/not functioning parts into a new properly working parts

2. Purpose of Gene Delivery

Gene expression study

- To study how cells change/react or what cells produce when a certain type of gene is inserted.

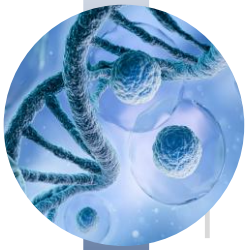
- To study what the target gene's function is

- E.g.) pressing each button to see what it does

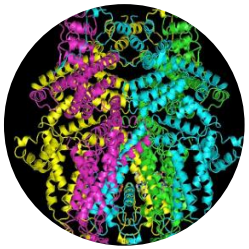
2. Purpose of Gene Delivery

Healthy cell

DNA/RNA inserted



Target protein produced



Target protein production

- To manipulate cell to make massive amount of the target protein such as insulin or antibodies needed for drug
- E.g.) a factory producing proteins in bulk using a blueprint

Transfection

1. **Broad Applicability in Eukaryotic Cells**

- Transformation is limited to bacteria; transduction uses viral vectors with safety concerns

2. **Safety**

- Non-viral transfection reduces immunogenicity and insertional mutagenesis risk

3. **Compatibility with Advanced Technologies**

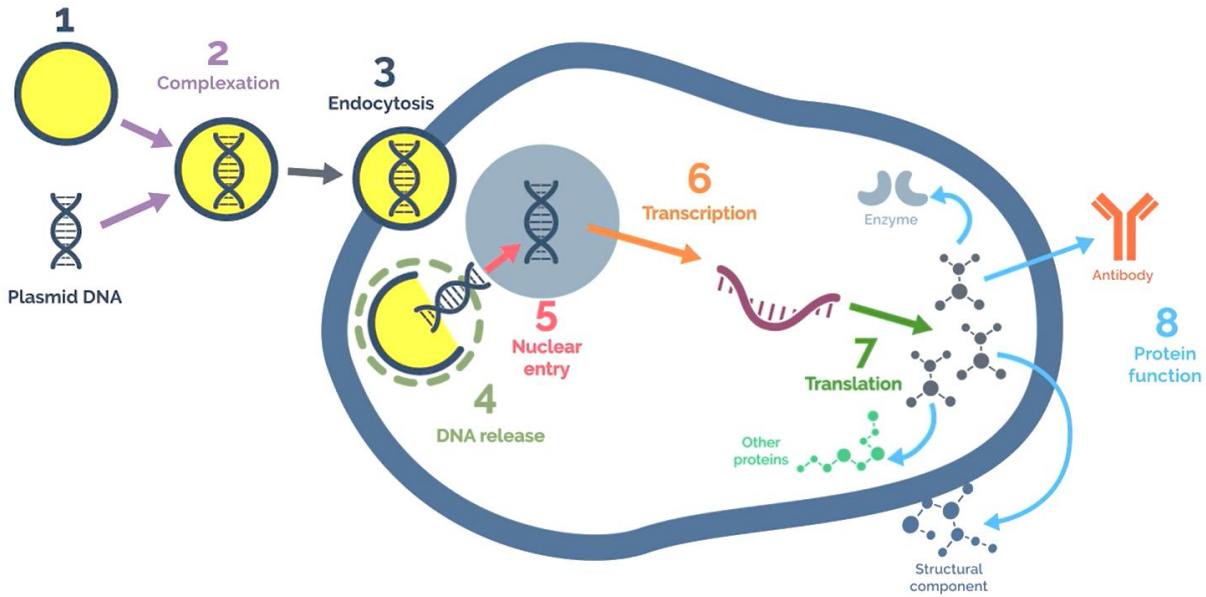
- Essential for CRISPR gene editing, mRNA therapeutics, and vaccine development

4. **Cost-effectiveness and Ease of Use**

- Simpler and more economical than viral vector production

1. Types of Transfection

Chemical Transfection



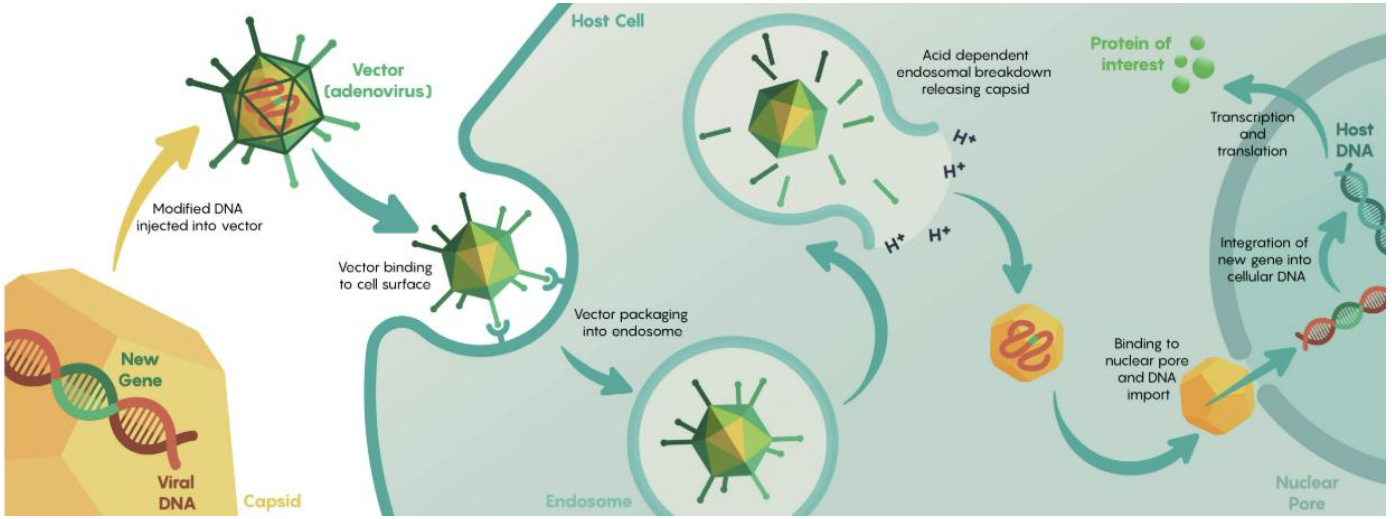
Chemical transfection uses

positively charged reagents to coat negatively charged nucleic acids,

facilitating their entry into cells by neutralizing charge repulsion.

1. Types of Transfection

Biological Transfection(Transduction)



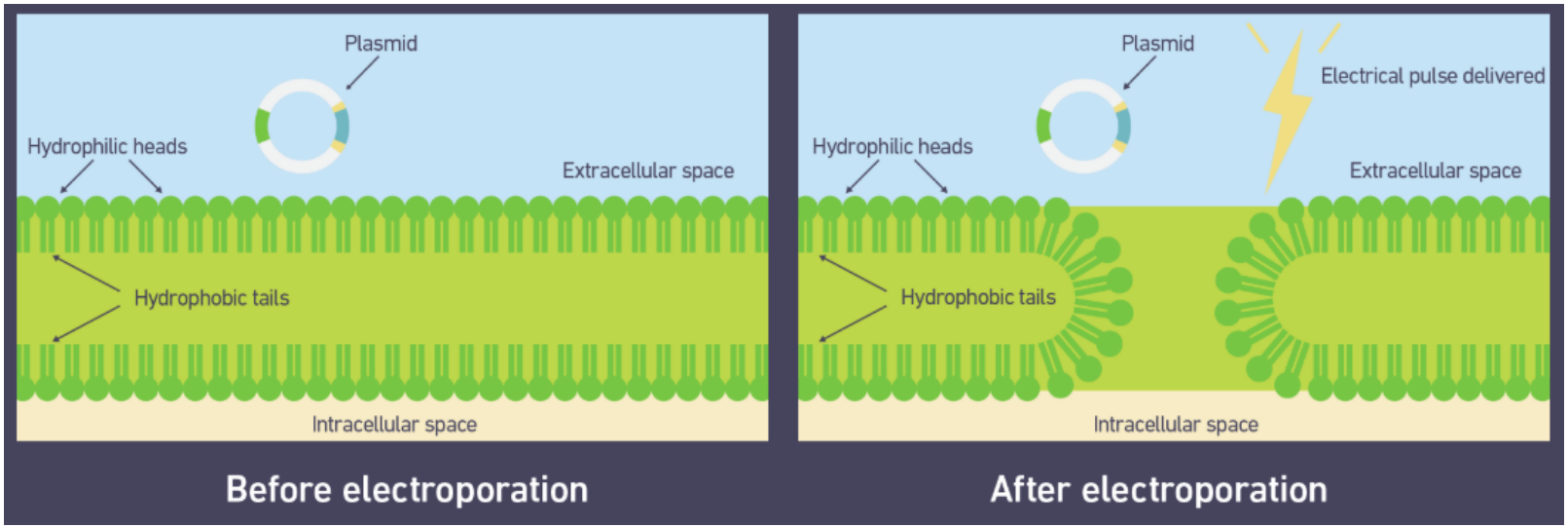
Biological transfection(viral transduction) utilizes

engineered viruses to deliver genetic material into host cells by

leveraging the virus's natural ability to infect and insert genes into the genome.

1. Types of Transfection

Electroporation



Electroporation transfection delivers genetic material into cells by applying an electrical pulse that temporarily permeabilizes the cell membrane.

1. Types of Transfection

Types based on the purpose

	Chemical	Physical	Biological
Description	Using chemical substance to help penetrate through cell membrane	Using a device, a direct action given to a cell to make a temporary pores on the membrane	Using a virus, gene is transferred to a cell
Mechanism	1. Binds to gene and forms a complex 2. Enters the cell by fusion with the membrane or via endocytosis	1. Making temporary entrance on the membrane for genes to enter 2. Physically inserting the gene inside a cell	A virus is manipulated and used to transportation of gene
Example	Lipofection, calcium phosphate	Electroporation, microinjection	Adenovirus, lentivirus
Advantages	1. Simple 2. Cost-effective	Can be applied to various cell types	High efficiency and stability of gene transfer
Disadvantages	1. Efficiency may vary depending on the types of cell 2. Can be toxic to cells	1. Possible cell damage 2. Requires a device	1. Safety issue 2. Complex steps

1. Types of Transfection

Market Size

	Competitor	Market Size
Viral infection	Addgene, SBI, Sigma-Aldrich, Thermo-Fisher	Market share: 30% Revenue: 750 million USD
Lipofection	Thermo-Fisher (Lipofectamine), Polyplus, Mirus	Market share: 60% Revenue: 1.5 billion USD
Electroporation	Neon, Lonza, Bio-Rad, MaxCyte, BTX	**Market share: 10%** **Revenue: 25 million USD**

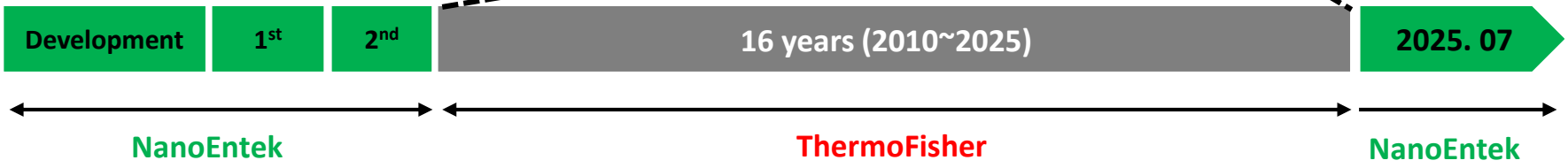
NanoEntek

ExTransfection™

Electroporation system

History of ExTransfection

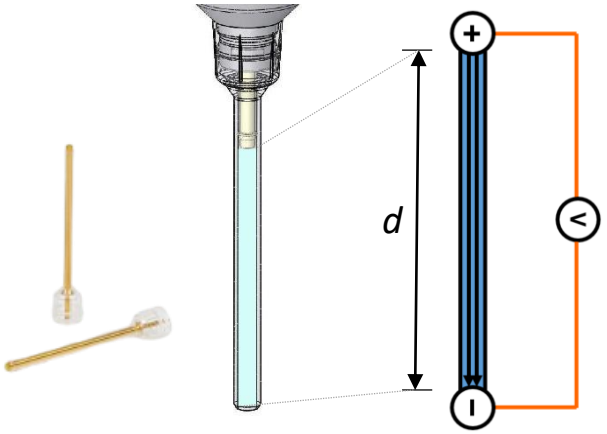
2001~2004	2005~2007	2008~2010	2010~2023	2025. 07
				
Prototype	1st MicroPorator	2nd MicroPorator	Neon	3rd ExTransfection



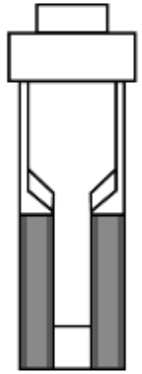
- **Proven Longevity** : Neon has been a trusted electroporation system for 16 years.
- **Global adoption** : Over **7,200 units** have been installed worldwide.
- **High consumable demand** : Annually, **15,000–20,000 consumables** are sold.
- **Research contributions** : Widely used in scientific studies and innovative projects.
- **Customer loyalty** : Maintains strong trust through quality and support.

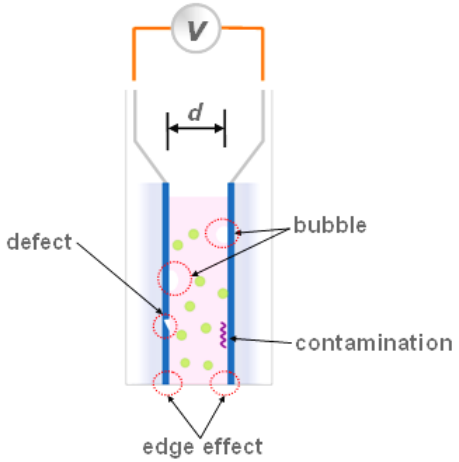
ExTransfection_Technology

Electric Field $E = \frac{V}{d}$



VS





ExTransfection™ Gold-Tip

Small electrode surface area with an **insulated capillary** ensures a consistent electric field due to the extended distance between the electrodes.

Bubble formation and electrolysis tends to be **minimized** with Gold-Tip. Thus, ExTransfection™ Gold-Tip **increases cell transfection efficiency.**

Consistent Electric Field
Cell damage is minimized
Transfection efficiency & cell viability are enhanced.

Conventional Cuvette

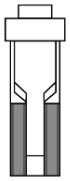
The **short distance** between the electrodes and the **wide electrode surface area** result inconsistent electric field in cuvette.

Bubble formation and edge effects in cuvettes result in **uneven cell distribution**, leading to an **inconsistent electric field.**

Inconsistent Electric Field
Cell damage is increased
Transfection efficiency & cell viability are lower.

ExTransfection_Technology

ExTransfection™ Gold-Tip



Conventional Cuvette

ExTransfection™ Gold-Tip		Conventional Cuvette
Uniform electric field due to small electrode surface area	Electric Field	Uneven electric field due to large electrode surface area
Minimal heat generation	Heat Generation	Excess heat generated
Maintains stable pH	pH Stability	pH fluctuations due to electrode corrosion
Produces fewer ions	Ion Formation	Increased ion release
Gold-coated electrodes resist corrosion	Durability	Aluminum electrodes degrade over time
Low mechanical stress (high cell viability)	Shear Force	High mechanical stress

ExTransfection Kit Components

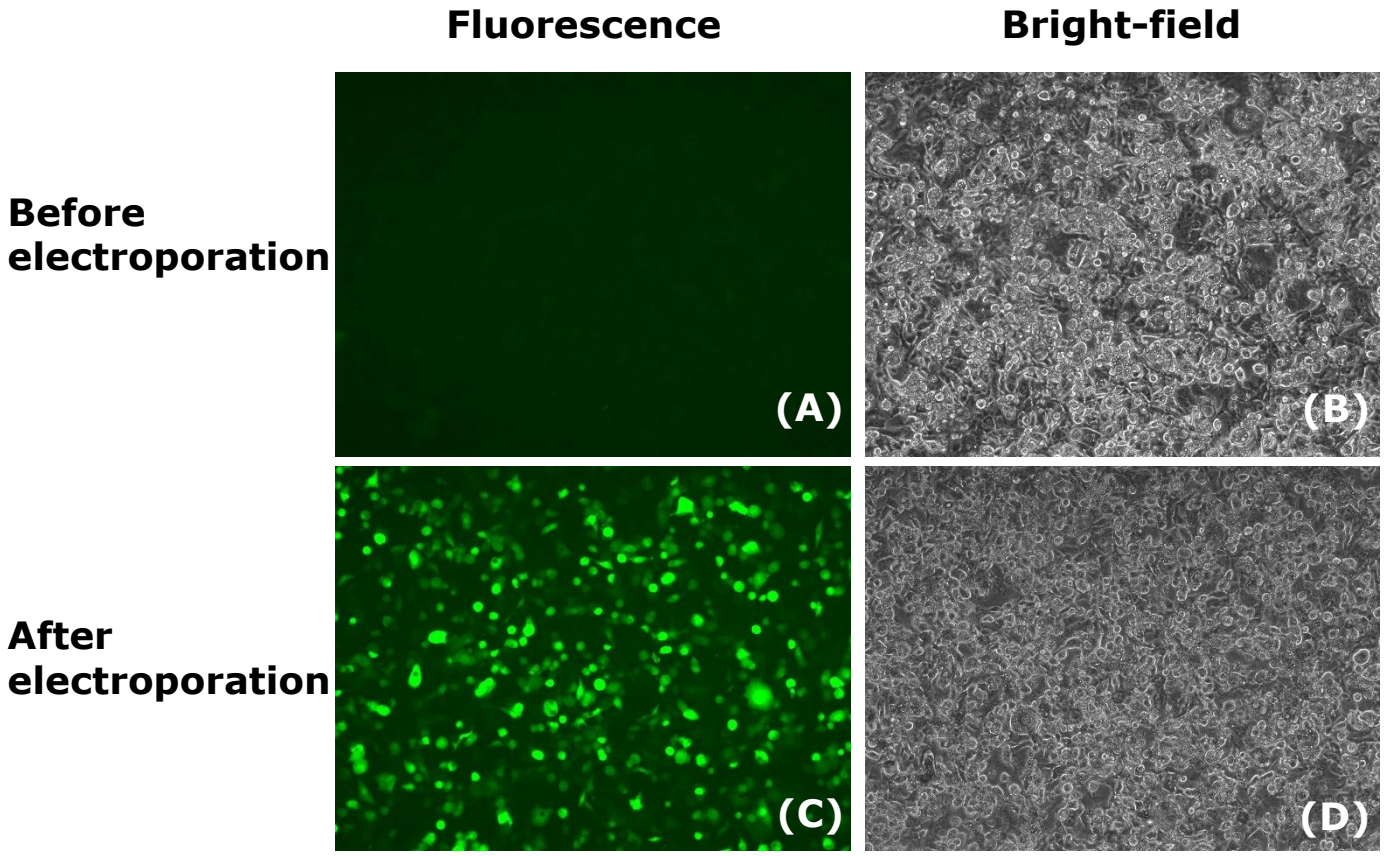
1. **Resuspension buffer R:** buffer commonly used to resuspend standard cell lines with DNA for electroporation.

2. **Resuspension buffer T:** buffer specifically designed for T cells and other sensitive cell types, optimized to maximize cell viability during electroporation.

3. **Electrolytic buffer E:** For use with 10uL ExTransfection tip

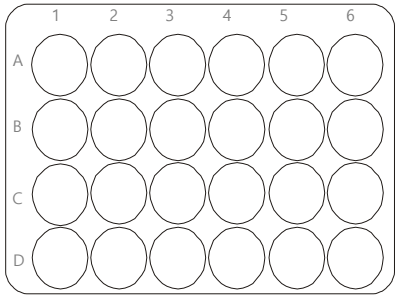
4. **Electrolytic buffer E2:** For use with 100uL ExTransfection tip

ExTransfection_How to use



ExTransfection_Demo Procedure

Cell line library

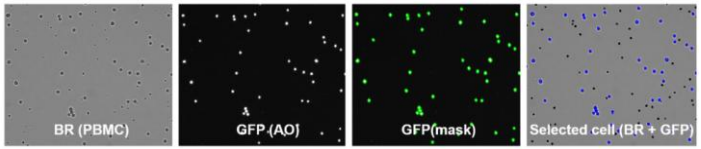


Electroporation !

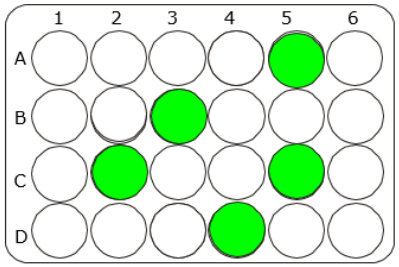
1st Day

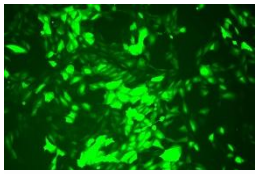
2nd Day

GFP, Flow cytometry



Analysis





ExTransfection_Demo Procedure

Cell Preparation
EVE plus

Live Cell Imaging
Juli-stage

Electroporation
ExTransfection

Cell Analysis
Adam II-LS
EVE HT FL

Key values and Differentiators

Customer feedback

"It was genuinely helpful. I can now perform tests I previously avoided due to low transfection efficiency."
— Alina Mares

"It's easy to use, slightly more affordable than the previous system, and has great features like the database function. I highly recommend it."
— Dr. Lydia Wunderley

"Very cost-effective. It always succeeds in transfection, saving time and effort. It's incredibly efficient and reliable."
— Claire Demenis

"It's much faster than reagent-based transfection systems. Instead of taking over an hour, it completes transfection in just under 5 minutes."
— Mathlew Hayley

Neon™ NxT Electroporation System vs. Neon™ Transfection System

Specification	 Neon NxT Electroporation System	 Neon Transfection System
Pipette type	1-channel and 8-channel options	1-channel only
Electroporation Volume	10 µL or 100 µL	10 µL or 100 µL
Electroporation buffer volume*	2 mL	3 mL
Tip attachment	ClipTip technology	Friction
Electroporation pulses	1–10	1–10
Pulse duration	1–100 ms	1–100 ms
Pulse voltage	500–2,500 V	500–2,500 V
Arc detection	Yes	No
Cloud connectivity	Yes	No
Pulse generator dimensions**	9.5 x 7.6 x 9.9 in. (W x H x D) 11. 9 lb (5.4 kg)	9.5 x 8.9 x 13.6 in. (W x H x D) 13. 8 lb (6.25 kg)
Cable management feature***	Yes	No
Touch display	8-inch capacitive touchscreen	7-inch touchscreen
Electrical rating	100–240 VAC, 270 W	100–240 C, 150 W

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- Pre-saved, frequently used cell-specific optimization protocols are stored.
- Tablet PC instead of touch screen