Multitalented for transfection and cell fusion

Eppendorf Multiporator®

eppendorf

The intelligent system for multiple applications

Multiporator®

Product features

- Compact unit is easily portable
- Easy to disinfect
- Easy to operate with clear, user-friendly display
- Directly adjustable voltage and time constants
- Soft Pulse technology
- Patented microprocessor-controlled pulse discharge*
- Data documentation via printer or PC
- Optimized buffer system
- Outstanding safety levels provided by the built-in cuvette chamber
- CE-, UL- and CAS-approved
- Connectors for external electrodes
- Upgrade with optional functional modules
- Two-year warranty

* US Patent 6008038

Is the electroporation of eukaryotic cells, bacteria and other microorganisms, as well as the electrofusion of cells possible with only one device? Yes, when that device is the perfect space- and time-saving Eppendorf® Multiporator modular system.

Choose the model with the appropriate modules for your application areas—no additional devices or peripherals are required. Simply select the desired application with the push of a button.

See our applications online or download protocols at **www.eppendorf.com**, where you will find answers to your application questions, as well as technical information about our electroporation and electrofusion product line.

Multiporator: Electroporation

Electroporation product features

- Soft Pulse technology (pulses in the µ-second range)
- Patented* microprocessor-controlled pulse discharge
- Innovative hypoosmolar buffer system

Application

- Electroporation of animal and human cells, primary cells, plant cells and oocytes
- Stable and transient transfection of eukariotic cells
- Efficient and gentle transfer of siRNA
- Electroporation of bacteria, yeasts and other microorganisms

- Multiporator with electroporation module

Multiporator: Cell fusion

Electrofusion product features

- Selectable alignment parameters
- Square-wave pulse
- Helix fusion chamber and Micro fusion chamber
- Connection options for external fusion electrodes

Application

- Generation of hybridoma cells for the production of monoclonal antibodies
- Fusion of immune and tumor cells for the vaccination of tumor diseases
- Fusion of plant protoplasts
- Cloning of mammals
- Generation of tetraploid blastocysts
- Fusion of artificial lipid vesicles

- Multiporator with cell fusion module and Helix fusion chamber

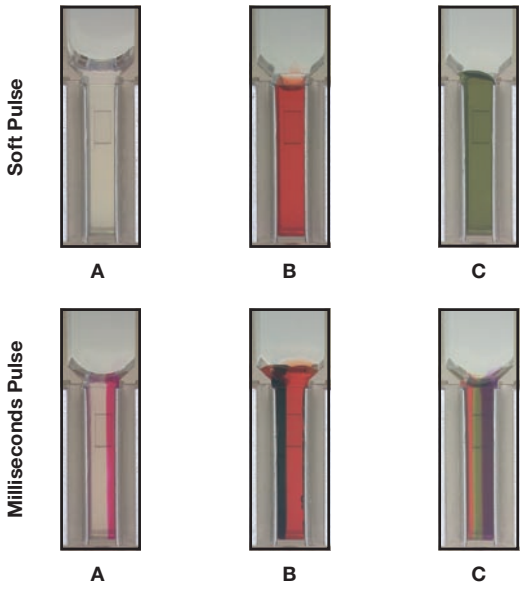
* US Patent 6008038

The right impulse for high standards

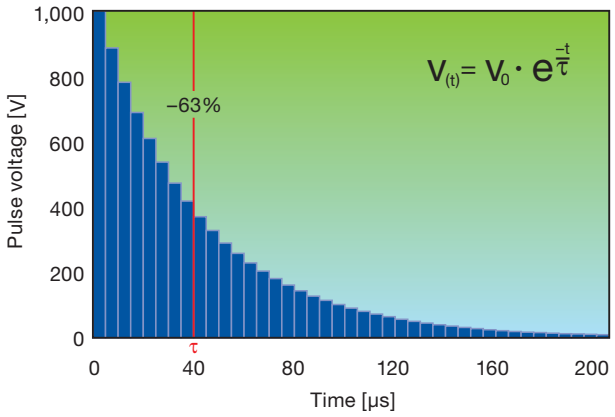
Electroporation

The principle
Electroporation is a simple, efficient method for importing foreign molecules into cells. An electronic impulse makes the cell membrane temporarily permeable to allow DNA and other macromolecules, such as RNA, antibodies, peptides, pharmaceuticals or dyes, to penetrate into the cell. Electroporation causes minimal biological and toxic side effects, and it is a useful technique for cells that show a low transfection efficiency when using other methods.

A well thought-out system for outstanding transfection rates with eukaryotic cells
Save on valuable cell material with Eppendorf's Soft Pulse technology; cell-damaging influences, such as the electrophoresis of cell content or pH changes, are considerably minimized. The extremely short pulses lead to very high survival rates.[1]



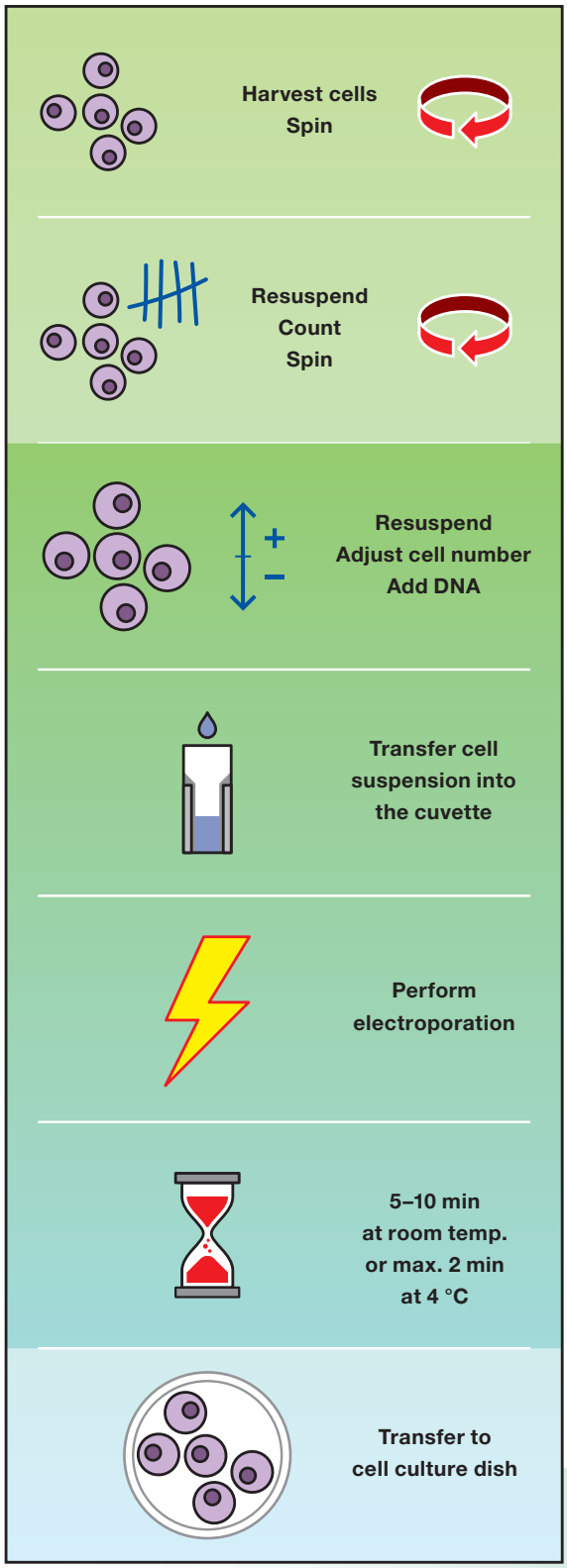
● **Effect of the pulse length on the pH ratios for electroporation**
Top: No pH change is detectable with the Soft Pulse Multiporator. Bottom: Using milliseconds pulse leads to drastic pH changes. pH indicators are immobilized by the addition of 1% agarose to the electroporation buffer (top) or PBS (bottom) in 4 mm cuvettes:
A: Phenolphthalein pH >8
B: Congo red pH <3
C: Merck® Universal Indicator pH <4 and >10



● **Multiporator Soft Pulse technology**
The exponential voltage drop of the microsecond pulse is regulated electronically every 5 µs. The time constant ▼ indicates the time at which the pulse voltage has dropped to approximately 37% of the original value.

Equally important to successful electroporation is the low conductive Eppendorf buffer system, which is adjusted to the Soft Pulse technology. The sodium-free buffer system is adapted to the inner cell environment and stabilizes the Na^+/K^+ gradient across the cell membrane, so even highly sophisticated transfection experiments are possible.

An electrodeformation of the cells is possible in the hypoosmolar electroporation buffer, and the membrane breakthrough can take place in a targeted fashion under gentle conditions.[2] This results in exceptionally high transfection rates.



● Schematic process of electroporation with the Multiporator

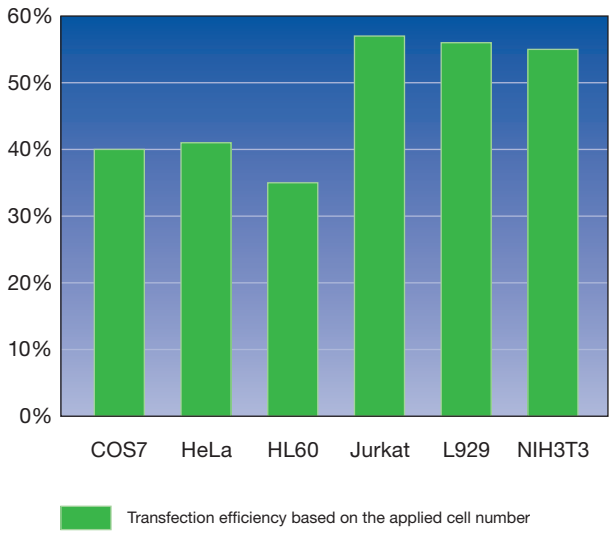
The path to consistently accurate results begins with the simple input of parameters that define an exponential pulse—voltage and time constants. The patented microprocessor control system of the Multiporator ensures precision of the pulse discharge and the high reproducibility of results.

Well-conceived electronics

The bacteria module of the Multiporator makes electroporation of bacteria, yeasts and other microorganisms easier with the proven combination of optimized time constants and a wide voltage range. The electronic safety switch of the integrated cuvette holder avoids short circuits or arcing that may affect conventional devices, thereby offering special safety advantages.

Perfect cuvettes

Eppendorf electroporation cuvettes are available in three different gap widths. They are manufactured according to the highest precision standards, sterilized by gamma radiation and thoroughly inspected. The cuvettes can be used in all of the usual devices and with the most diverse cell types. A special lid shape minimizes the splashing of cell suspension and provides convenient handling.



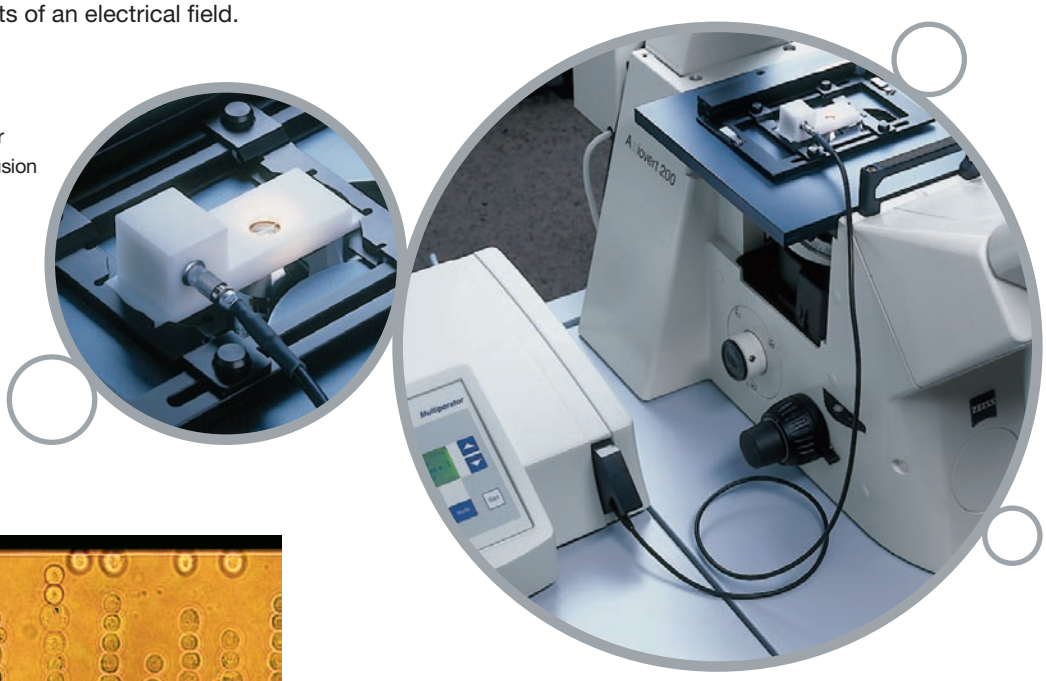
● **Transient transfection of various adherent and cell lines**
Cells were electroporated with the plasmid using the Multiporator; over 50% transient transfection possible based on the number of cells used.

The professional system for perfect fusion

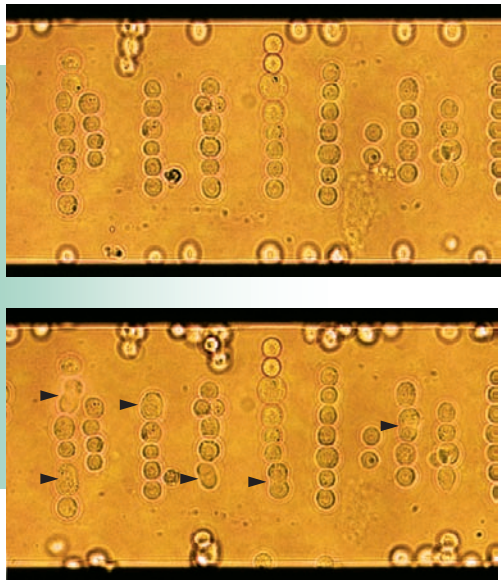
Electrofusion

The principle
In cell fusion, two or more cells of the same or different origins, including their complete structures (nucleus, membranes, organelle, cell plasma), fuse to create a new, viable cell. Electrofusion is based upon a reversible structural change of the cell membranes, which is caused by the effects of an electrical field.

Applicable for a wide spectrum of cells, this physical method is distinguished by minimal biological, chemical and toxic side effects.[3]



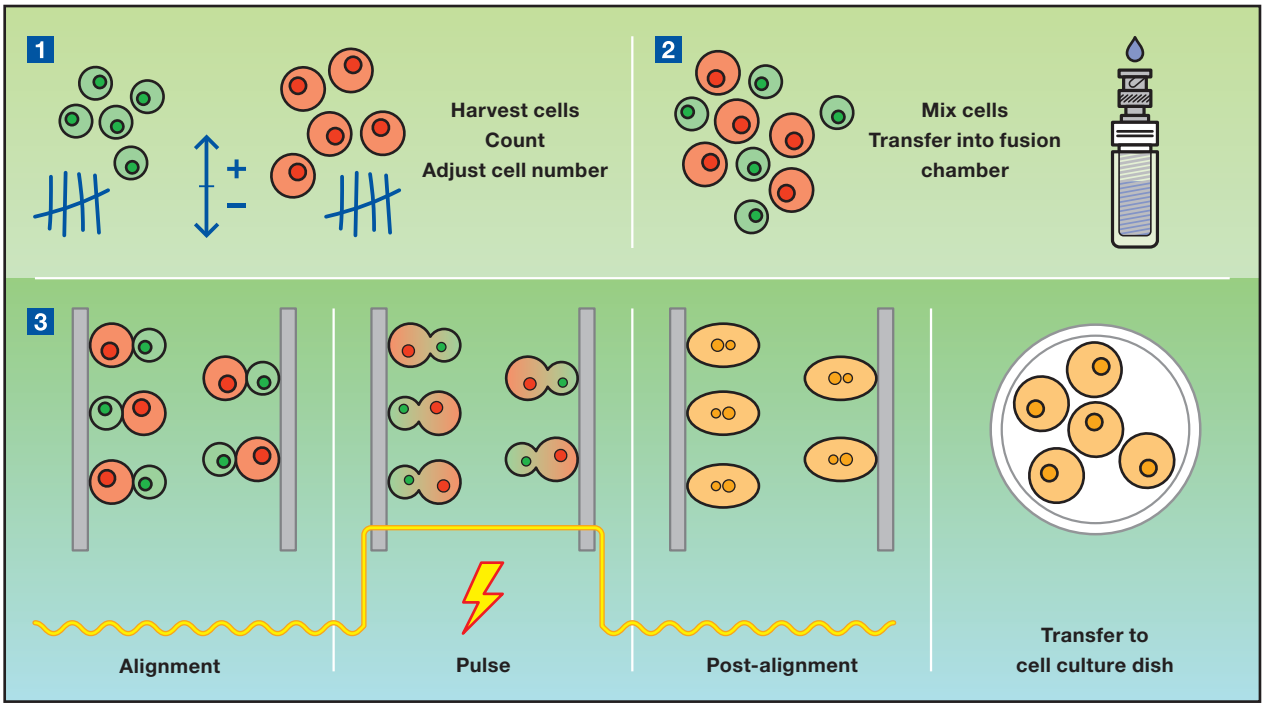
● Micro fusion chamber for observing electrofusion under a microscope



● Microscopic image of cells in the Micro fusion chamber (0.2 mm gap width)
Top: alignment; below: fusion products (labeled)

The system advantage
The electrofusion buffer system used with the Multiporator also contributes toward increased efficiency. The hypo-osmolar electrofusion buffer stretches the cell membrane and relaxes the cell skeleton, thus simplifying fusion in the electrical field. Cell-damaging influences, such as long pulse times and high voltages, are reduced.

Three precisely manufactured chambers with platinum electrodes are available for electrofusion: the Helix fusion chamber with a volume capacity of 250 µl and two Micro fusion chambers for efficient optimization of experimental parameters and other applications; one with 0.2 mm gap width and the other with a 0.5 mm gap width.

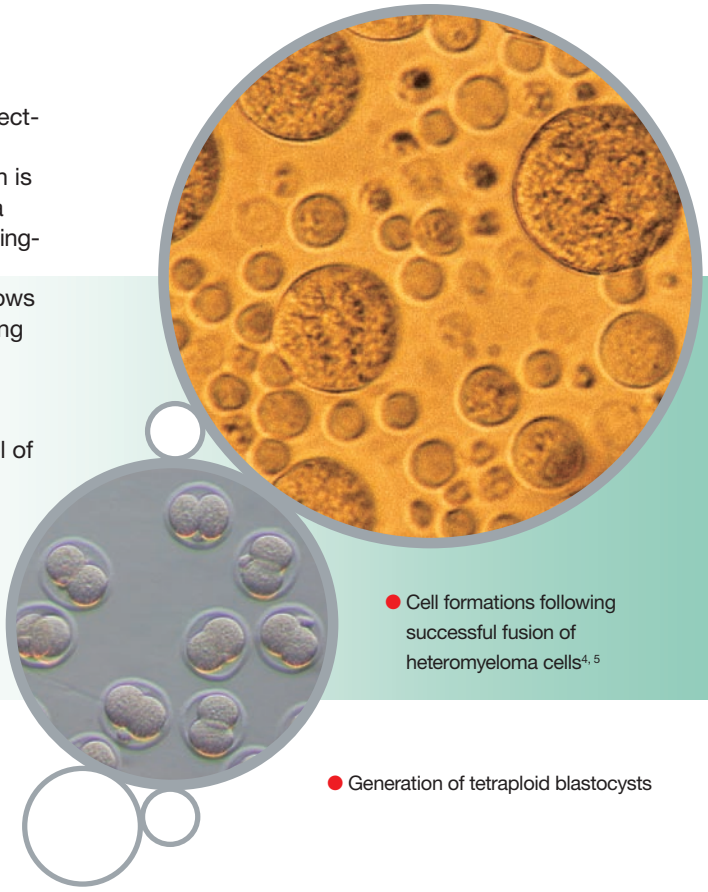


● Schematic process of cell fusion with the Multiporator

Controlled contact

The Multiporator offers the option of individually selecting alignment parameters both before and after the pulse. An essential prerequisite for successful fusion is the direct contact of the cells with one another. As a result of dielectrophoresis in a high frequency, alternating-current field, the cells move toward and settle upon each other. The square-wave pulse that directly follows causes fusion of the cells. With the help of an ensuing alternating-current field, the cohesion of the fusion product can be supported and the yield increased.

The Micro fusion chamber provides the highest level of flexibility by allowing rapid and simple optimization of the fusion parameters under microscopic control. Optimize your cell fusion parameters using the Electrofusion Buffer System with only a few cells in the Micro fusion chamber. The ideal parameters determined in this way can be directly transferred to the cell fusion in the Helix fusion chamber when the 0.2 mm gap width Micro fusion chamber is used.



● Cell formations following successful fusion of heteromyeloma cells[4, 5]

● Generation of tetraploid blastocysts

Multiporator

Technical specifications

Eukaryotic module	
Pulse voltage:	20–1,200 V
Pulse form:	Exponentially diminishing, electronically controlled
Time constant:	15–500 µs, in increments of 5 µs
Multiple pulsing:	1–99, with 1 min time interval
Interface:	RS-232

Technical specifications

Fusion module	
Pulse voltage:	5–300 V
Pulse width:	15–300 µs, in increments of 5 µs
Pulse form:	Square-wave pulse
Multiple pulsing:	1–99, in time intervals of 1 s
Sinus voltage:	1–10 V_p, symmetrically to 0 V
Frequency:	2 MHz Sinus
Time range:	0–95 s before and after pulses

Technical specifications

Bacteria and yeast module	
Pulse voltage:	200–2,500 V
Pulse form:	Exponentially diminishing
Time constant:	5 ms (nominal)
Resistance:	600 Ω
Capacitor:	10 µF
Special feature:	Electronic safety switch for eliminating short-circuits

We thank Phytowelt GreenTechnologies GmbH, Nettetal, Germany (plant protoplast fusion) and Ronald Naumann, Transgenic Core Facility, MPI of Molecular Cell Biology and Genetics, Dresden, Germany (Cover page, page 7 (tetraploid blastocysts)) for providing us with pictures.

Literature

[1] Friedrich, et al. Bioelectrochem Bioenerg. 1998;47:103–111.
[2] Sukhorukov VL, et al. J Membrane Biol. 1998;163:235–242.
[3] Zimmerman U, Neil G, ed. Electromanipulation of Cells. CRC Press; 1996.
[4] Krenn, et al. Hum Antibod Hybridomas. 1995;6:47–51.
[5] Vollmers, et al. Hybridoma. 1993;12:221–225.

Our Application Notes are available at: www.eppendorf.com

Ordering information

Description	Order no.
Multiporator	
for eukaryotic cells	4308 000.015
for eukaryotic cells, bacteria and yeasts	4308 000.023
for eukaryotic cells and cell fusion, with 1 Helix fusion chamber and 1 Micro fusion chamber	4308 000.031
for eukaryotic cells, bacteria, yeasts and cell fusion, with 1 Helix fusion chamber and 1 Micro fusion chamber	4308 000.040
Electroporation Buffer System	
Hypoosmolar, sterile, 100 ml	4308 070.501
Isoosmolar, sterile, 100 ml	4308 070.510
Electrofusion Buffer System	
Hypoosmolar, sterile, 100 ml	4308 070.528
Isoosmolar, sterile, 100 ml	4308 070.536
Micro fusion chamber	
gap width 0.2 mm	4308 030.003
gap width 0.5 mm	4308 031.000
Electroporation cuvettes	
Electroporation cuvettes, gap width 1 mm, 100 µl, sterile	4307 000.569
Electroporation cuvettes, gap width 2 mm, 400 µl, sterile	4307 000.593
Electroporation cuvettes, gap width 4 mm, 800 µl, sterile	4307 000.623

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