株式会社ベックス
BEX CO.,LTD

Excellent Electroporator for *in-vitro* & *in-vivo* electroporation

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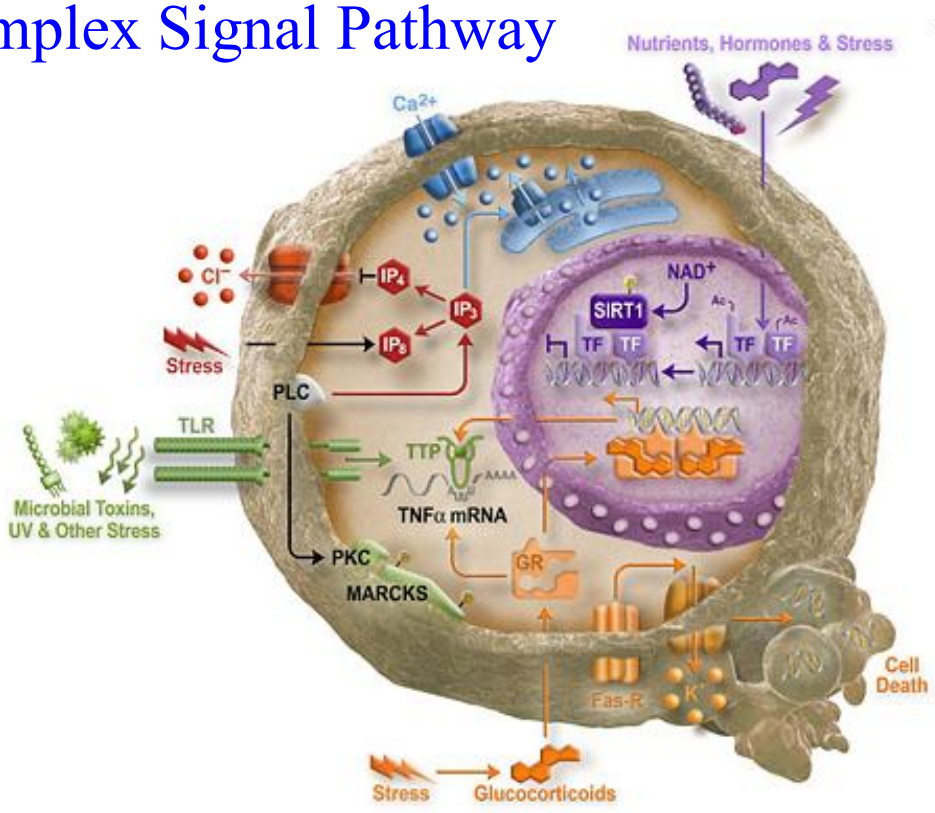
Specialist：許譽騰

1

Complex Signal Pathway



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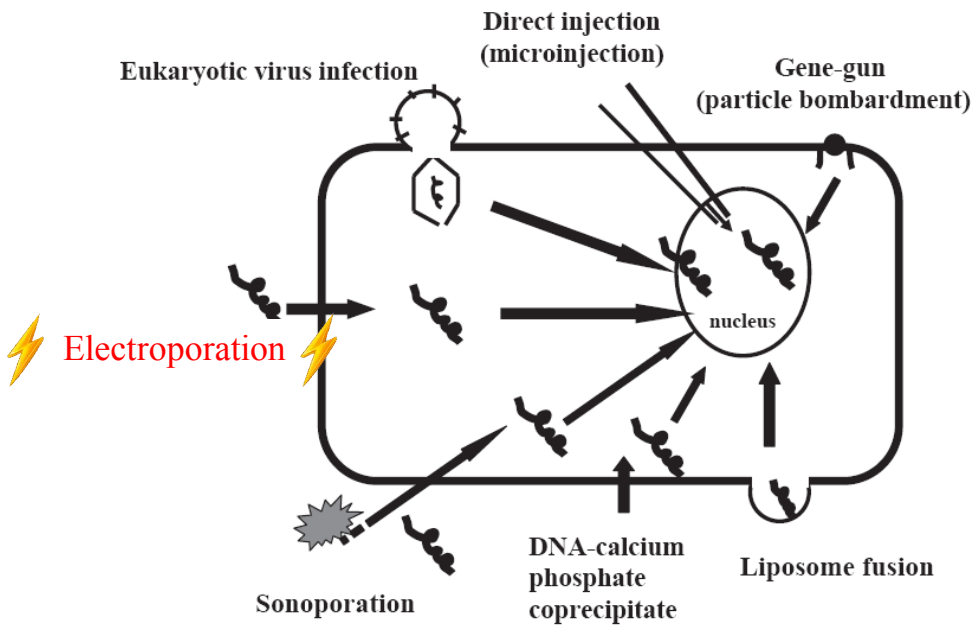

3

Biotechnol Adv. 2006. 24:1-16.

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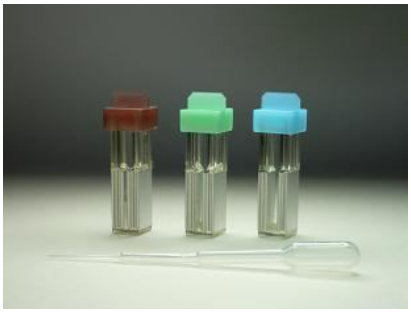
In vitro EP is affected by variable factors:

- Cell type
- Cell number
- Buffer



Fluctuation in resistance (R）

Ohm's law (I=V/R)

Fluctuation in current (I)

4

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In-vivo EP is affected by variable factors:

- Size of a biological sample
- Gap between electrodes
- Position of an electrode
- Exhaustion of an electrode

Fluctuation in resistance (R）

Ohm's law (I=V/R)

Fluctuation in current (I)

Laboratory Investigation (2004) 84, 836–844, advance online publication, 3 May 2004; doi:10.1038/labinvest.3700098

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How to get consistence & stable result?

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Why is our electroporator needed?

Conclude that fluctuation in current affects a result

Solution?

Control and check current (I)

There is the optimal current range for each application. The current must be controlled to be in the range. In addition, it is necessary to check whether the actual current is in the optimal range.

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Why is our electroporator needed?

How?

Our electroporator provides the useful tools:

1. Resistance measurement function

This function enables one to measure the resistance prior to EP and is very useful when the experiment is carried out repeatedly.

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Why is our electroporator needed?

How?

Our electroporator provides the useful tools:

1. Resistance measurement function

In in vivo EP, the resistance changes due to variable factors. The fluctuation in resistance leads to the fluctuation in current. Therefore, current can be controlled by checking and adjusting resistance value. The resistance can be adjusted by changing the position of an electrode slightly.

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Why is our electroporator needed?

How?

Our electroporator provides the useful tools:

2. Current measurement function

The actual amperage will be measured and displayed immediately after EP. With this function, one can verify the electroporation process before confirming the electroporation result.

Save your time!

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Why is our electroporator needed?

Other advantages?

3. Accurate voltage control

The voltage around 50V is often used in in vivo EP and is controlled accurately.

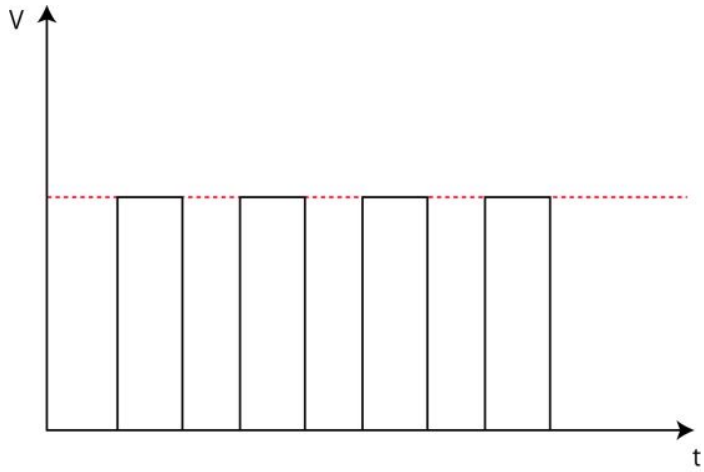
In vitro electroporator is calibrated to the high range of voltage. Therefore, the voltage below 50V is inaccurate.

Why is our electroporator needed?

Other advantages?

3. Accurate voltage control

Voltage is accurate and precise until the last pulse



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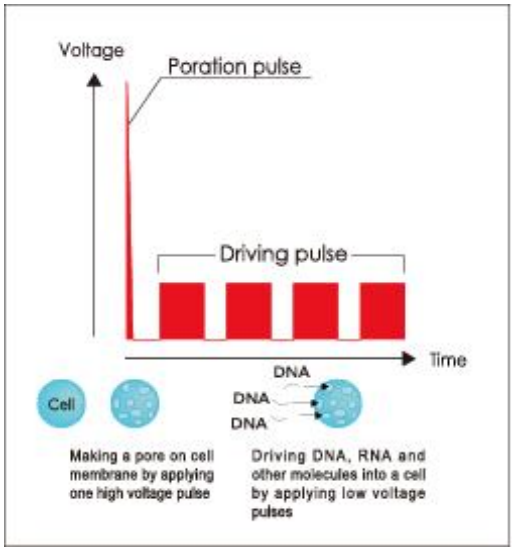
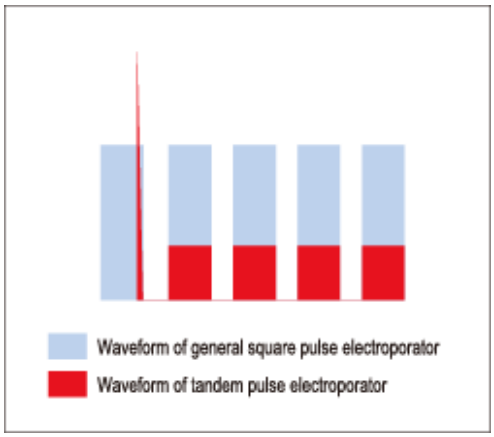
Unique Dual Pulse electroporation



Tandem pulse electroporation



General square pulse & Tandem pulse electroporation

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Why is our electroporator needed?

Other advantages?

4. Safety limit

Safety limit function protects one from the serious injury during electroporation. When the amperage exceeds the limit, the electroporation stops immediately.

For CUY21Vivo-SQ , limit is 1.60A

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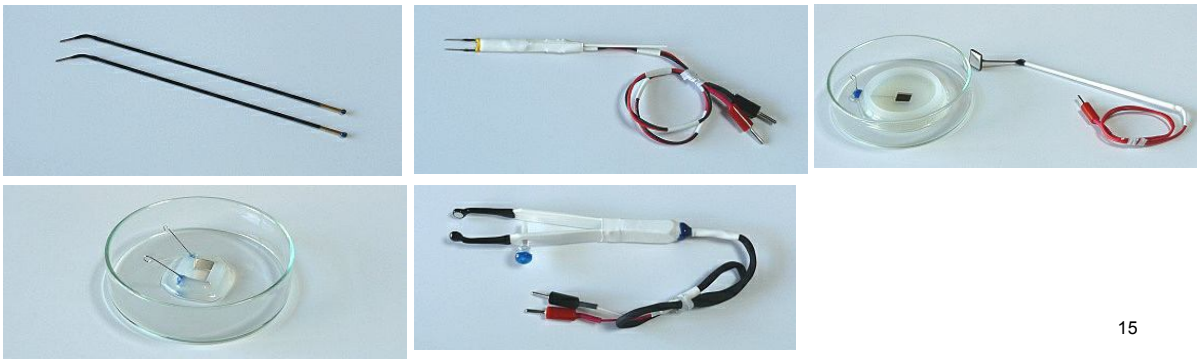
Why is our electroporator needed?

Other advantages?

5. Various kinds of electrodes are available.

There are many kinds of electrodes to meet the requirement for each application.



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Applications

Our electroporator is designed for :

- *In-vivo* electroporation
  - Mouse/Rat: Liver, Pancreas, Brain, Muscle, Skin, Testis, Ovary…etc
  - Zebrafish: Retina, Fin
  - Others: Honey bee's brain, Hatched chick's brain, Medaka's embryo
- *In-ovo* electroporation
  - Ectoderm, Mesoderm, Endoderm, Neural tube
- *Ex-vivo* electroporation
  - Brain slice, Tissus slice
- *In-utero* electroporation
  - Mouse/Rat: Ventricle, Inner ear, Spinal cord

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Application Filed:

Role of Gene

- Embryo development
- Neuron development → chick embryo
- Medical research, such as cancer research, gene therapy…etc.
- Animal behavior
- Learning & memory

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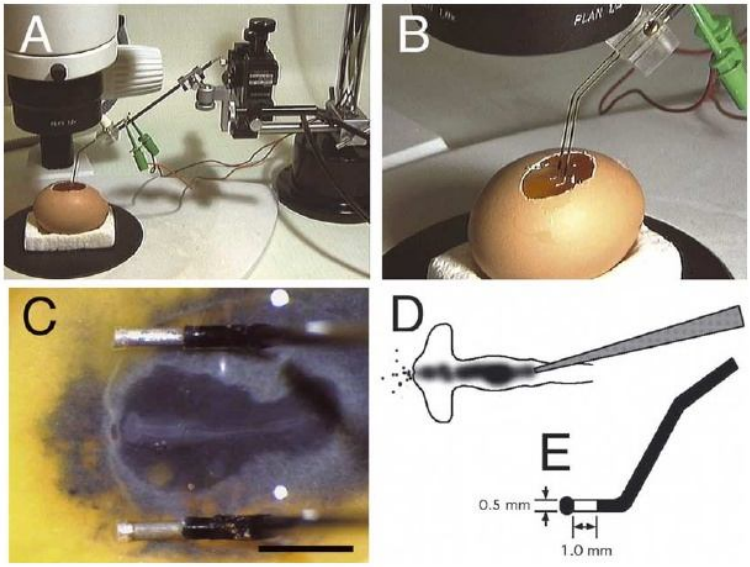
Applications

In ovo electroporation

H. Nakamura et al. / Mechanisms of Development 121 (2004) 1137–1143



Species : Chick embryo (HH10)
Target : Neural tube

Electrode : LF613P1

EP parameters
Voltage : 25V
Pulse length : 50msec
Pulse interval : 100msec
No. of pulses : 3-5 times

Optimal amperage : 0.00-0.03A

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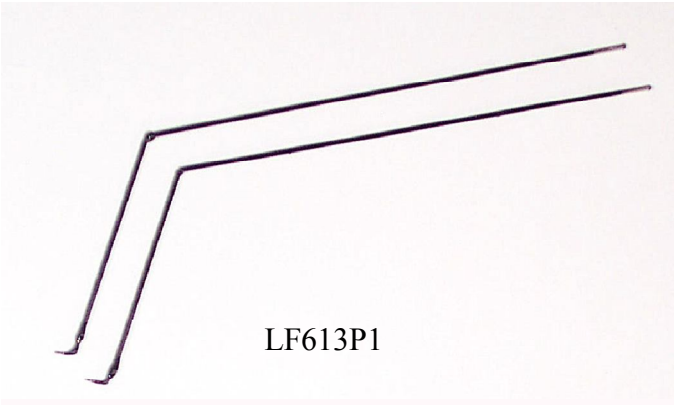
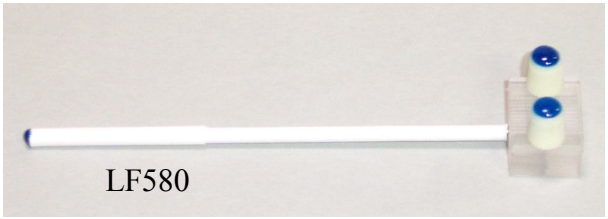
Applications

In ovo electroporation





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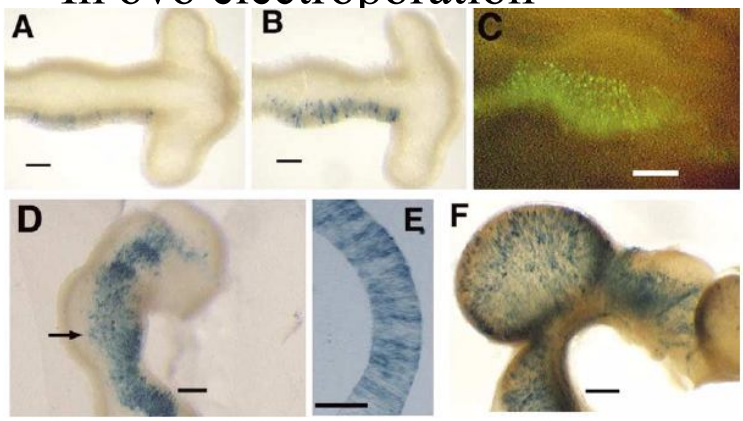
Applications

In ovo electroporation



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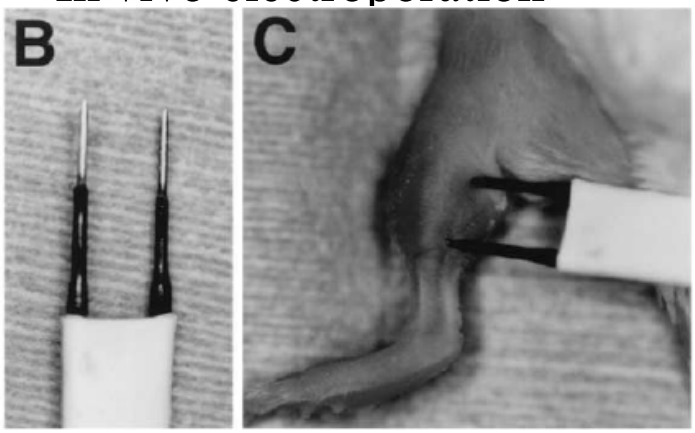
Applications

In vivo electroporation



Kishimoto et al Bone Vol. 31 No.2 Aug. 2002:340-347

Species : Mouse
Target : Limb's muscle
(gastrocnemius)

Electrode : LF560S5

EP parameters
Voltage : 100V
Pulse length : 50msec
Pulse interval : 950msec
No. of pulses : 3 times
3 times (reverse polarity)

Amperage : Around 0.15A
(0.05-0.30A)

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Applications

In vivo electroporation

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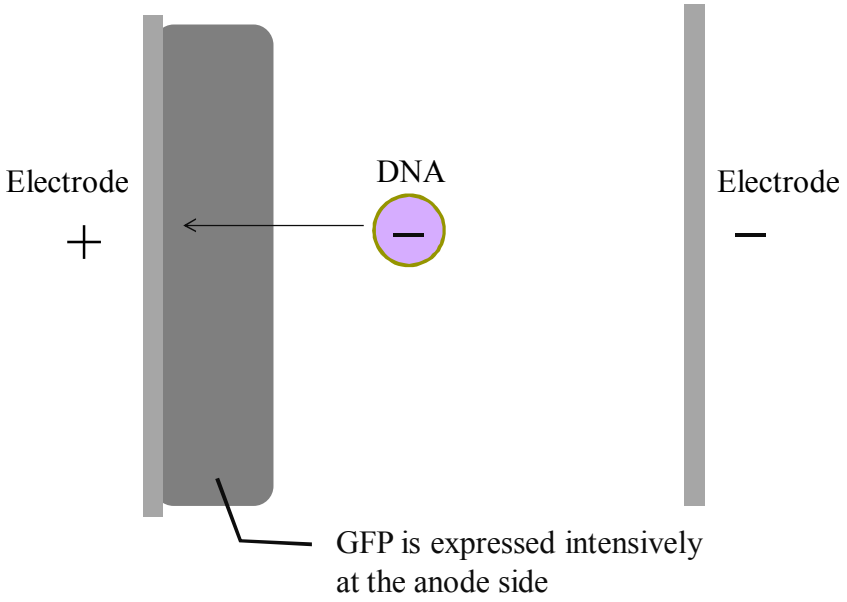
Applications

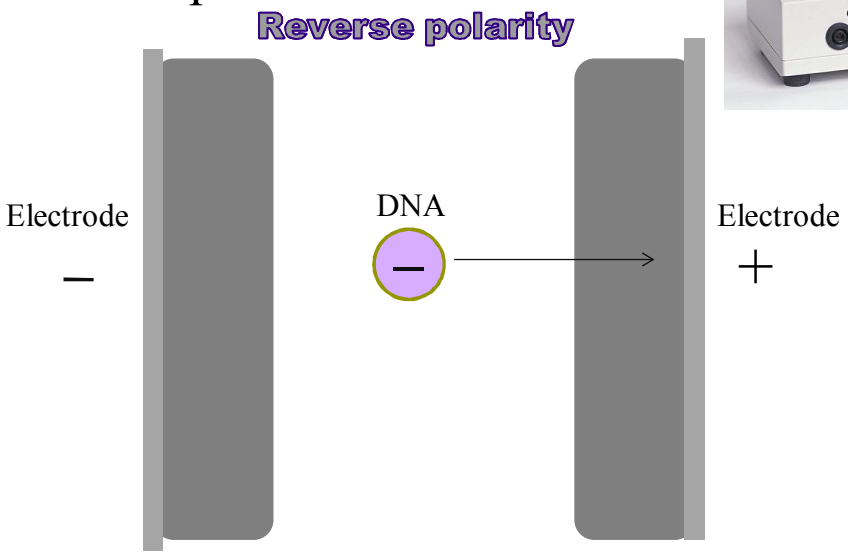
In vivo electroporation



Applications

In vivo electroporation

LF902



Expression area increases by 25%

Applications

In vivo electroporation

Species : Mouse
Target : Brain

Electrode : LF200S

EP parameters
Voltage : 40V*
Pulse length : 2msec
Pulse interval : 98msec
No. of pulses : 10 times
* Voltage may vary

Optimal amperage : 4-6mA

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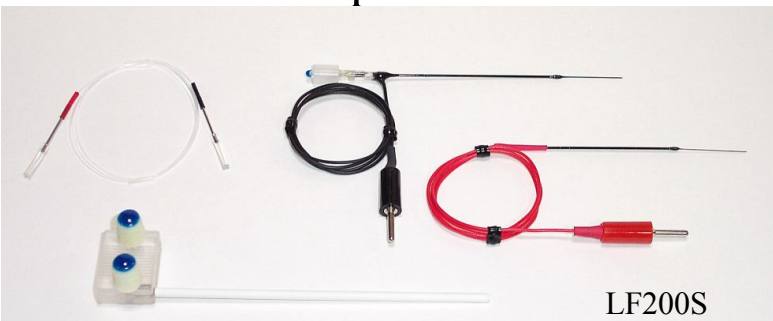
Applications

In vivo electroporation



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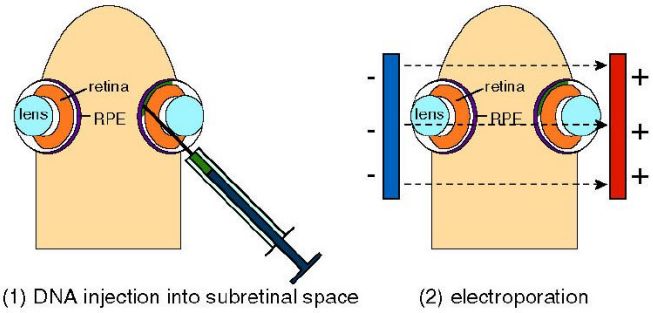
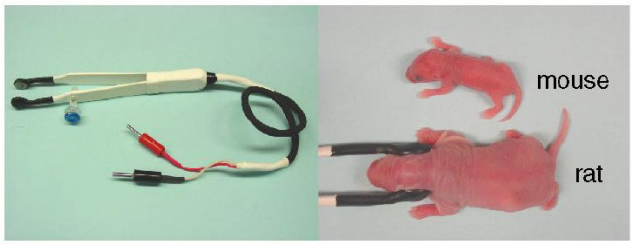
Applications

In vivo electroporation





Matsuda et al 16–22 PNAS January 6, 2004 vol. 101 no. 1

Species : Newborn mouse and rat
Target : Retina

Electrode : LF650P7

EP parameters
Voltage : 80V for mouse / 100V for rat
Pulse length : 50msec
Pulse interval : 950msec
No. of pulses : 5 times

Optimal amperage : 0.03-0.05A

Applications

In vivo electroporation

Species : Newborn mouse and rat
Target : Retina

Electrode : LF650P7

EP parameters
Voltage : 80V for mouse / 100V for rat
Pulse length : 50msec
Pulse interval : 950msec
No. of pulses : 5 times

Optimal amperage : 0.03-0.05A

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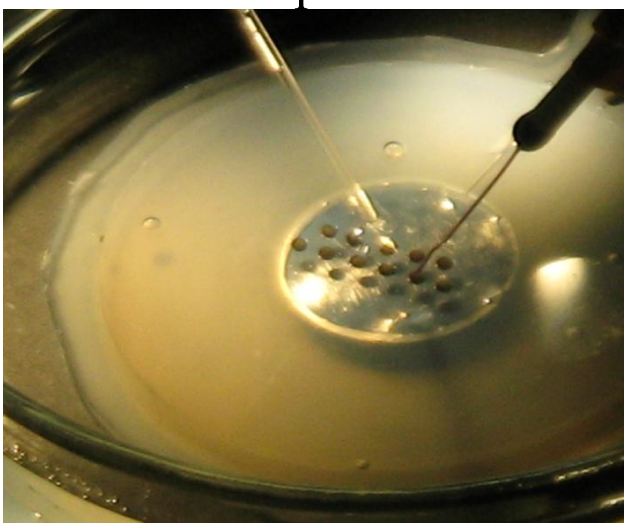
Applications

In ovo electroporation



Species : Xenopus embryo

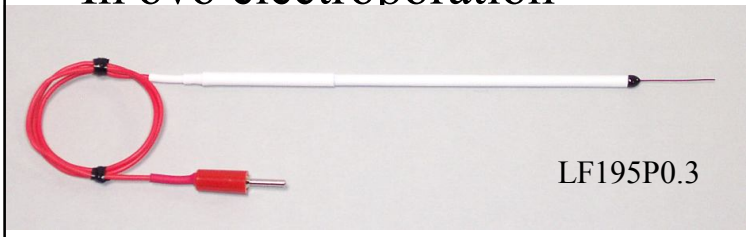
Electrode : LF700P20E
LF195P0.3 or 0.5

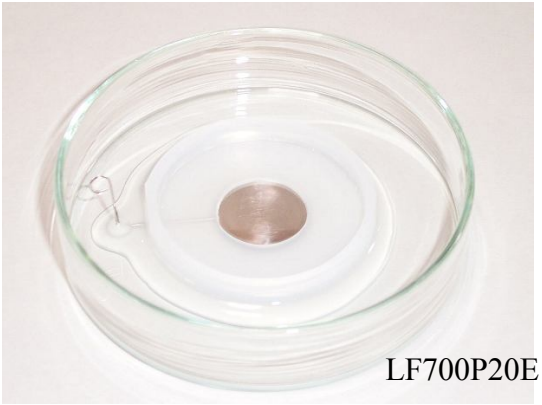
EP parameters
Voltage : 20V for mouse
Pulse length : 5msec
Pulse interval : 95msec
No. of pulses : 10 times

Optimal amperage : 0.01-0.04A

Applications

In ovo electroporation





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Target : Retina

Electrode : LF700P20E
LF195P0.3 or 0.5

EP parameters
Voltage : 20V for mouse
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Pulse interval : 95msec
No. of pulses : 10 times

Optimal amperage : 0.01-0.04A

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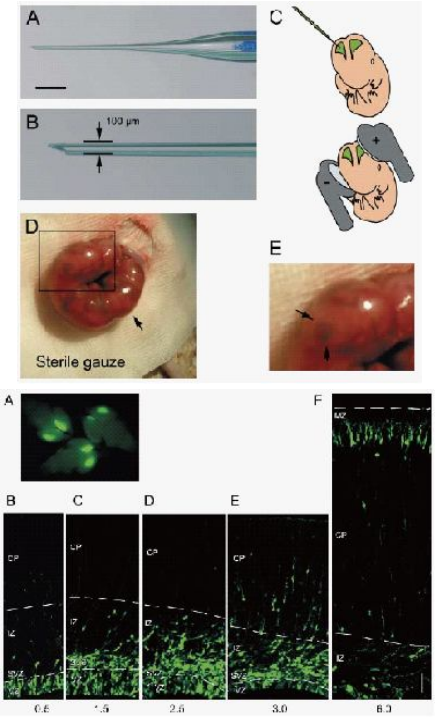
Applications

In utero electroporation



Species : Mouse embryo
Target : brain

Electrode : LF650P3 *1
LF650P5 *2

EP parameters
Voltage : 33V -35V
Pulse length : 30msec*1/50msec*2
Pulse interval : 970msec*1/950msec*2
No. of pulses : 4 times

Optimal amperage : 0.3-0.6A

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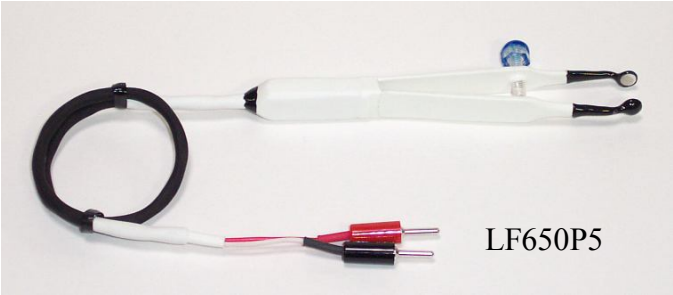
Applications

In utero electroporation



Species : Mouse embryo
Target : brain

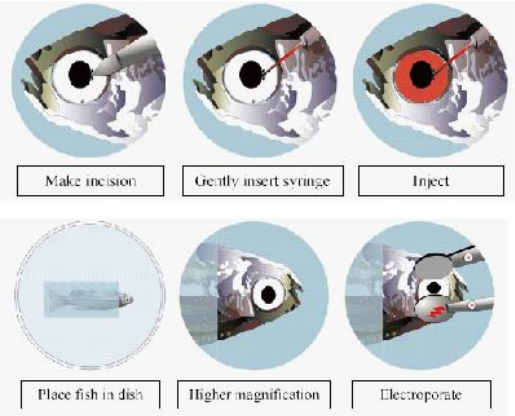
Electrode : LF650P3 *1
LF650P5 *2

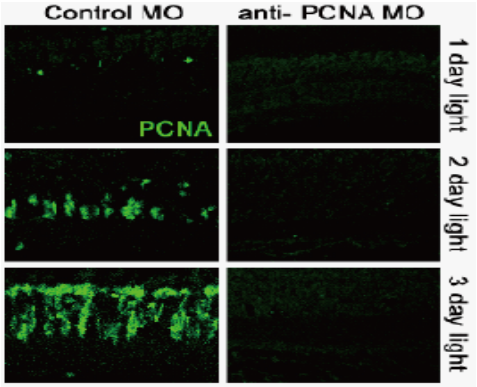
EP parameters
Voltage : 33V -35V
Pulse length : 30msec*1/50msec*2
Pulse interval : 970msec*1/950msec*2
No. of pulses : 4 times

Optimal amperage : 0.3-0.6A

Applications

In vivo electroporation



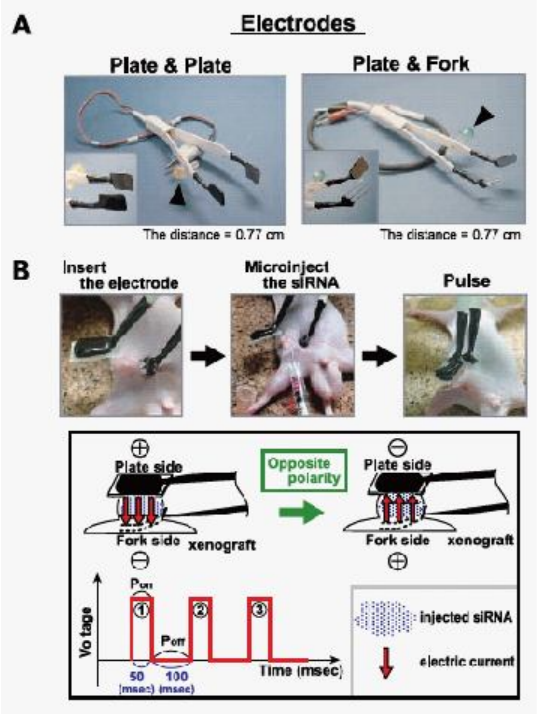


Species : Zebrafish
Target : Retina
Electrode :LF650P3

EP parameters
Voltage : 75V
Pulse length : 50msec
Pulse interval : 950msec
No. of pulses : 4 times

Applications

In vivo electroporation



Mol Cancer Ther. 2008 7(1):211-21.

Species : Mouse
Target : Tumor tissue

Electrode :LF663S3

EP parameters
Voltage : 70V
Pulse length : 50msec
Pulse interval : 100msec
No. of pulses : 3 times
3 times (reverse polarity)

Optimal amperage : 0.05~0.3A

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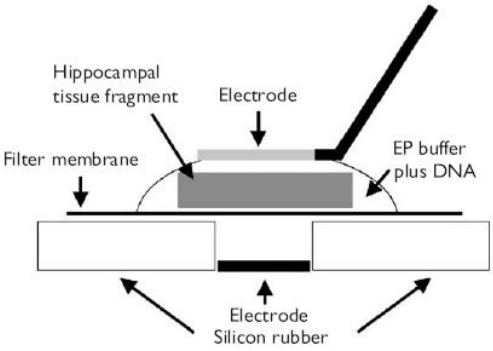
Applications

Ex vivo electroporation



Okabe et al DEVELOPMENTAL NEUROSCIENCE
Vol 15 No 6 29 April 2004

Species : Mouse
Target : Brain slice

Electrode :LF701P2E
LF701P2L or tungsten needle

EP parameters
Voltage : 15V
Pulse length : 5msec
Pulse interval : 995msec
No. of pulses : 5 times
5 times (reverse polarity)

Optimal amperage : 0.02A

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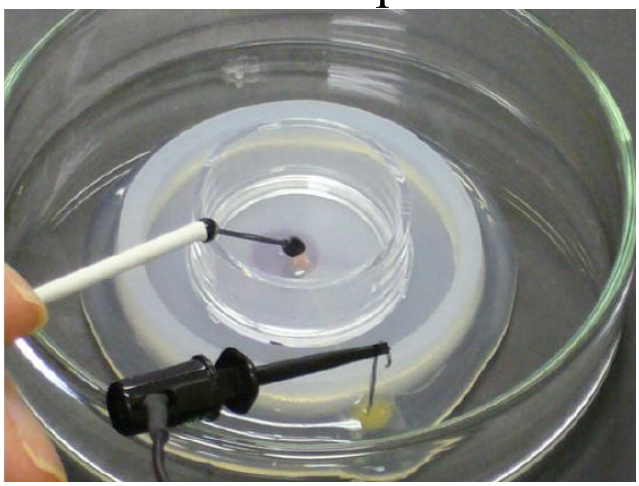
Applications

Ex vivo electroporation



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5 times (reverse polarity)

Optimal amperage : 0.02A

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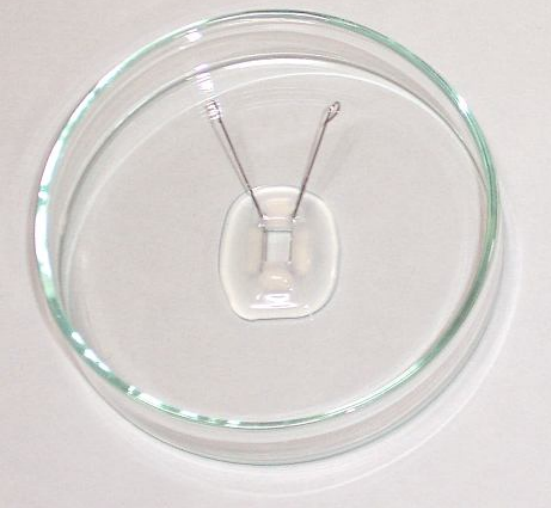
Applications

Ex vivo electroporation

For extracted organ and tissue



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Unique function of BEX Electroporator

- Resistance measurement function
- Current measurement function
- Accurate voltage control
- Dual pulse function
- Safety limit

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Thanks for your attention!

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三典科技股份有限公司
您科學研究的好伙伴
TEL：03-3273889
服務專線：0800-327388
http://www.sunpointworld.com
E-mail:sunpoint@sunpointworld.com