Tech-Trends

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Cutaneous plasmid delivery using in vivo electroporation

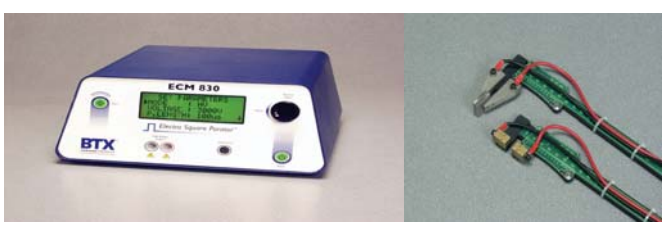
Comparison of electrically mediated and liposome-complexed plasmid DNA delivery to the skin

Background:
Electroporation is an established technique for enhancing plasmid delivery to many tissues *in vivo*, including the skin. We have previously demonstrated efficient delivery of plasmid DNA to the skin utilizing a custom-built four-plate electrode. The experiments described here further evaluate cutaneous plasmid delivery using *in vivo* electroporation. Plasmid expression levels are compared to those after liposome mediated delivery.

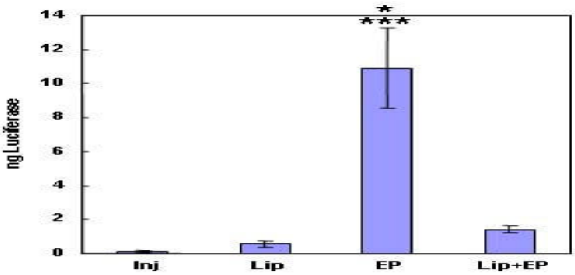
Methods:
Enhanced electrically-mediated delivery, and less extensively, liposome complexed delivery, of a plasmid encoding the reporter luciferase was tested in rodent skin. Expression kinetics and tissue damage were explored as well as testing in a second rodent model.

Results:
Experiments confirm that electroporation alone is more effective in enhancing reporter gene expression than plasmid injection alone, plasmid conjugation with liposomes followed by injection, or than the combination of liposomes and electroporation. However, with two time courses of multiple electrically-mediated plasmid deliveries, neither the levels nor duration of transgene expression are significantly increased. Tissue damage may increase following a second treatment, no further damage is observed after a third treatment. When electroporation conditions utilized in a mouse model are tested in thicker rat skin, only higher field strengths or longer pulses were as effective in plasmid delivery.

Conclusion:
Electroporation enhances reporter plasmid delivery to the skin to a greater extent than the liposome conjugation method tested. Multiple deliveries do not necessarily result in higher or longer term expression. In addition, some impact on tissue integrity with respect to surface damage is observed. Pulsing conditions should be optimized for the model and for the expression profile desired.



Stainless Steel Caliper Electrodes 1 x 1 cm Cat. 450101
ECM 830 Square Wave Generator Cat. 450052



Comparison of liposome and EP delivery of plasmid DNA.
Luciferase expression in mouse skin 48 hours after delivery of 100 µg gWizLuc as described in materials and methods. Inj, injection only, n = 12; Lip, liposomes, n = 12; Electroporation, EP, n = 12; Lip+EP, liposomes + EP, n = 4. ***p < 0.001 with respect to injection only; *p < 0.05 with respect to liposomes.

ECM ® 830 *in vivo* Electroporation Protocol

Animal Preparation:
Six to 7 week old female BALB/c mice (NCI) or 200–250 gram male Sprague Dawley rats were anesthetized in an induction chamber charged with 3% isoflurane in O_2 then fitted with a standard rodent mask and kept under general anesthesia during treatment. For plasmid delivery, 50 µl commercially available gWizLuc was used.

Electroporation settings:
Field strength: 100V/cm
Pulse Length: 150 ms
Pulses: 8

Electroporation Procedure:

Temperature:	Room Temperature
Volume:	50 µl
Transfectant:	2 µg/ul

References:
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